REPORT NO. 2

INDO-POLISH INDUSTRIAL FISHERIES SURVEY ALONG THE NORTH WEST COAST OF INDIA

PRELIMINARY REPORT OF THE SECOND CRUISE OF M. T. MURENA AND SUPPORTING VESSELS FOR THE PERIOD FROM 19th FEBRUARY TO 12th APRIL 1977

EXPLORATORY FISHERIES PROJECT
(MINISTRY OF AGRICULTURE AND IRRIGATION)
GOVT. OF INDIA
BOMBAY.

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Preliminary report of the second cruise of M.T. Murena and supporting vessels for the period from 19th February to 12th April, 1977

By

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MANGALORE.

May, 1977

EXPLORATORY FISHERIES PROJECT
GOVERNMENT OF INDIA
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B O M B A Y - 4 0 0 0 0 1.
INDIA

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PARTICIPANTS, PARTICIPATING AGENCIES AND VESSELS DEPLOYED FOR THE PROGRAMME

Participants	Participating agencies
M.T. MURENA	
2nd Cruise from 19-2-77 to 12-4-77	
Scientists	
Shri C. Mukundan, Scientist	Central Marine Fisheries Research Institute, Cochin
Shri K. Vijayakumaran, Assistant Director	Exploratory Fisheries Project, Bombay
Shri P.K. Vijayarajan, Scientist	Naval Physical Oceanographic Laboratory, Cochin
Shri W. Pelczarski, Scientist	M.T. Murena
Shri J.K. Knurowski, Oceanographer	M.T. Murena
Captain	
Shri P. Jasinski	M.T. Murena
Fishing technicians	
Shri P.M. George Kutty	Central Institute of Fisheries Nautical and Engineering Training, Cochin
Shri R.S. Manchekar	Exploratory Fisheries Project, Bombay base
Shri K.C. Januachan	Central Institute of Fisheries Nautical and Engineering Training, Cochin
Shri Jhontu Mondal	Exploratory Fisheries Project, Bombay base
M.V. BLUE FIN	
3rd Cruise from 22-3-77 to 2-4-77	
Technical officers	
Shri V. Narayan Pillai, Instructor (Oceanography & Marine Metereology)	Central Institute of Fisheries Nautical and Engineering Training, Cochin
Shri R. Rajendran, Instructor (Craft & Gear)	Central Institute of Fisheries Nautical and Engineering Training, Cochin
Fishing technician	
Shri R. Velayudhan, Skipper	Central Institute of Fisheries Nautical and Engineering Training, Cochin
M.F.V. MEENA BHARATI	
4th Cruise from 18-2-77 to 26-2-77	
5th Cruise from 7-3-77 to 14-3-77	
Fishing technician	
Shri S.S. Puthran, Skipper	Exploratory Fisheries Project, Bombay base

ADVISORY COMMITTEE ON INDO-POLISH FISHERIES RESOURCES SURVEY ON THE NORTH WEST COAST OF INDIA (MINISTRY's REF. NO.46-15/73-FY(B&A)/T-1) DATED 6th MAY, 1977).

1.	Sri S.P. Balasubramanian, Joint Secretary (Fisheries), Department of Agriculture, New Delhi	CHAIRMAN
2.	Director, Integrated Finance, Ministry of Finance, Krishi Bhavan, New Delhi	MEMBER
3.	Joint Commissioner(Fisheries), Department of Agriculture, New Delhi	MEMBER
4.	Secretary, Forest and Fisheries Department, Government of Maharashtra, Sachivalaya, Bombay	MEMBER
5.	Secretary, Agriculture and Co-operation Department, Government of Gujarat, Ahmedabad	MEMBER
6.	Director, Central Marine Fisheries Research Institute, Vincent Road, Cochin	MEMBER
7.	Director, Central Institute of Fisheries Nautical and Engineering Training, Cochin	MEMBER
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9.	Nominee of the Bombay Port Trust	MEMBER
10.	Nominee of the Ministry of Defence	MEMBER
11.	Director, Exploratory Fisheries Project, Bombay	MEMBER/CONVENOR

A C K N O W L E D G E M E N T S

The Indo-Polish Industrial Fisheries Survey along the North west coast of India has been started in pursuance of the agreement between the Ministry of Foreign Trade and Shipping (Polish People's Republic) and the Ministry of Agriculture and Irrigation (Government of India) which was signed on 26th August, 1976 at Warsaw. In pursuance of the agreement, the stern trawler M.T.Murena (69.34 m) arrived in India on 30th December, 1976 and the actual survey work was started from 8th January, 1977. The first and second cruises have been completed and report of the second cruise is being presented here. We express our sincere thanks to Shri K.S.Narang, Secretary, Smt. Anna Malhotra, Additional Secretary and Sri S.P. Balasubramanian, Joint Secretary (Fisheries), Ministry of Agriculture and Irrigation, Government of India for providing guide-lines and facilities of this programme. Professor P.C.George, Joint Commissioner (Fisheries) and Shri J.V.H.Dixitulu, Deputy Commissioner(ET) have taken active interest and provided valuable support and guidance.

The Consul of the Polish People's Republic Mr. Edmund Kaczmarek and his associates including Mr. P. Jasinski, Master of M.T. Murena along with his colleagues extended whole-hearted cooperation and we wish to thank them for their valuable assistance and cooperation.

We thank Sri D.A.S.Gnanadoss, Director, Central Institute of Fisheries, Nautical and Engineering Training, Cochin for his keen interest in the programme by providing M.V.Blue Fin as a supporting vessel and for the valuable advices given by him and by his colleagues especially Shri V.A.Puthran, Chief Instructor.

INTRODUCTION

Under a joint agreement between the Polish People's Republic and Government of India, a Polish vessel M.T. Murena is engaged at present in an industrial fisheries survey in the depth zone, 30-200 fathoms in the area between 15° N latitude to 24° N latitude. The aim of this joint venture is mainly to assess the nature, quality and quantity of commercially exploited fishes and other living resources - demersal, columnar and pelagic - and to assess factors contributing to the fluctuation in their availability. Further, the joint venture envisages to make available data for the preparation of feasibility report for the fishing industry with special reference to obtaining assistance from financial institutions and also to raise national capability in fishing technology with reference to the resources and areas mentioned.

A preliminary report of the first cruise of M.T. Murena and supporting vessels during the period from 8th January to 10th February, 1977 has already been released by Exploratory Fisheries Project in April, 1977. The present report, the second in the series, deals with the results of investigations based on the second cruise of M.T. Murena and the supporting vessels. The first cruise was entirely devoted to ground fish survey, whereas the second one was primarily aimed for pelagic survey and valuable informations has been gathered and are presented in this report. However, this being the first exhaustive survey of the pelagic resources along the North west coast of India and two more voyages are contemplated in respect to Pelagic Fish Survey during the course of this year by the same vessel, only the factual observations are given in this report. It is hoped that with more informations gathered during the subsequent voyages, it will be possible to give a comprehensive report of the availability of the resources along the North west coast.

VESSEL AND GEAR

The main features of the main vessel M.T. Murena and the supporting vessels, M.F.V. Meena Bharati and M.V. Blue Fin and the gear operated by them have been given in the earlier Report No.1 on Indo-Polish Industrial Fisheries Survey released by the Exploratory Fisheries Project, Bombay.

PORGRAMME OF WORK OF THE MAIN AND ANCILLARY VESSELS FOR THE SECOND VOYAGE

The approved programme of the main and ancillary vessels were as follows:

Name of vessel	Duration	No. of days	Purpose of investigation
M.T. MURENA Voyage No.II	From 19-2-77 to 12-4-77	*53(45)	According to the plan of survey, each cruise was scheduled to last for 40 days but five extra days have been provided to complete the work on (i)bottom trawling in strata 10 and 13 - left unfinished by cruise No.I and (ii)pelagic trawling from 15° N and 24°N latitude as per the track indicated in Fig. 1.
		45 days	

* The vessel had to return to the port due to engine trouble on 1-3-77 and after repairs proceeded again on 8-3-77 thus loosing about eight days.

Name of vessel	Duration	No.of days	Purpose of investigation
ANCILLARY VESSELS			
i) M.F.V. MEENA BHARATI			
Voyage No: 04/77	From 18-2-77 to 26-2-77	9	Exploratory bottom trawling in strata 10, 7 and 4 between 30-50 fathoms.
Voyage No: 05/77	From 7-3-77 to 14-3-77	8	Exploratory bottom trawling in strata 16 and 19 between 30-50 fathoms.
		17 days	
ii) M.V. BLUE FIN			
Voyage No: 03/77	From 22-3-77 to 2-4-77	12	Exploratory bottom/mid-water trawling in strata 7 and 10 (between 30-50 fathoms), 8, 9, 4, 5, 6, 1, 2 and 3 (between 30 - 200 fathoms).
		12 days	

DEVIATION FROM THE APPROVED PROGRAMME

M.T. Murena was scheduled to leave Bombay for the second voyage on 16-2-77 but due to certain engine repairs the vessel could leave the port only by 19-2-77. She had to return to the Port on 1-3-77 due to engine trouble and after repairs proceeded again on 8-3-77. After the completion of the voyage which lasted for 45 days, the vessel returned to Bombay on 12th April, 1977.

During the second voyage, 14 bottom trawl hauls and 121 pelagic trawl hauls were made. All the hauls made were representative in all, except haul Nos. 4, 40, 80 and 98 where there was malfunctioning or damage to the nets.

One of the ancillary vessels viz., M.F.V. Meena Bharati of Exploratory Fisheries Project conducted two voyages during this period, lasting for about 17 days whereas M.V. Blue Fin of Central Institute of Fisheries, Nautical and Engineering Training did only one voyage lasting for about 12 days. M.V. Blue Fin, due to repairs to the main/auxiliary engines proceeded back to Cochin after the completion of the second voyage on 15-2-77 and was in a position to resume the programme only by 22-3-77. The unloading of the fish catch for the third voyage was done at Bombay on 2-4-77.

METHODS OF OPERATION

Each standard pelagic survey station consisted of a plankton sampling by Indian ocean standard net, a bathythermograph cast and surface to bottom water sampling by Nansen bottle followed by a haul with the survey trawl. A 33/37 bottom trawl and for mid-water trawling, a 64 x 112 x 59/92 pelagic rope trawl and 59 x 88 x 33/66 pelagic trawls were used.

For the purpose of pelagic survey work, the area lying between 30-200 fathoms depth zones from 15° N to 24° N have been divided into 10 sampling zones (Fig. 1). It was agreed that a diurnal change in behaviour pattern is common for many species with school formation during day time and a scattering layer during the night. In such cases, it was envisaged that the best conditions are found during the night time. The day time should then be spent surveying with the echo sounder and sonar for areas with schools and these areas should then be surveyed the following night when the fishes are dispersed in layers.

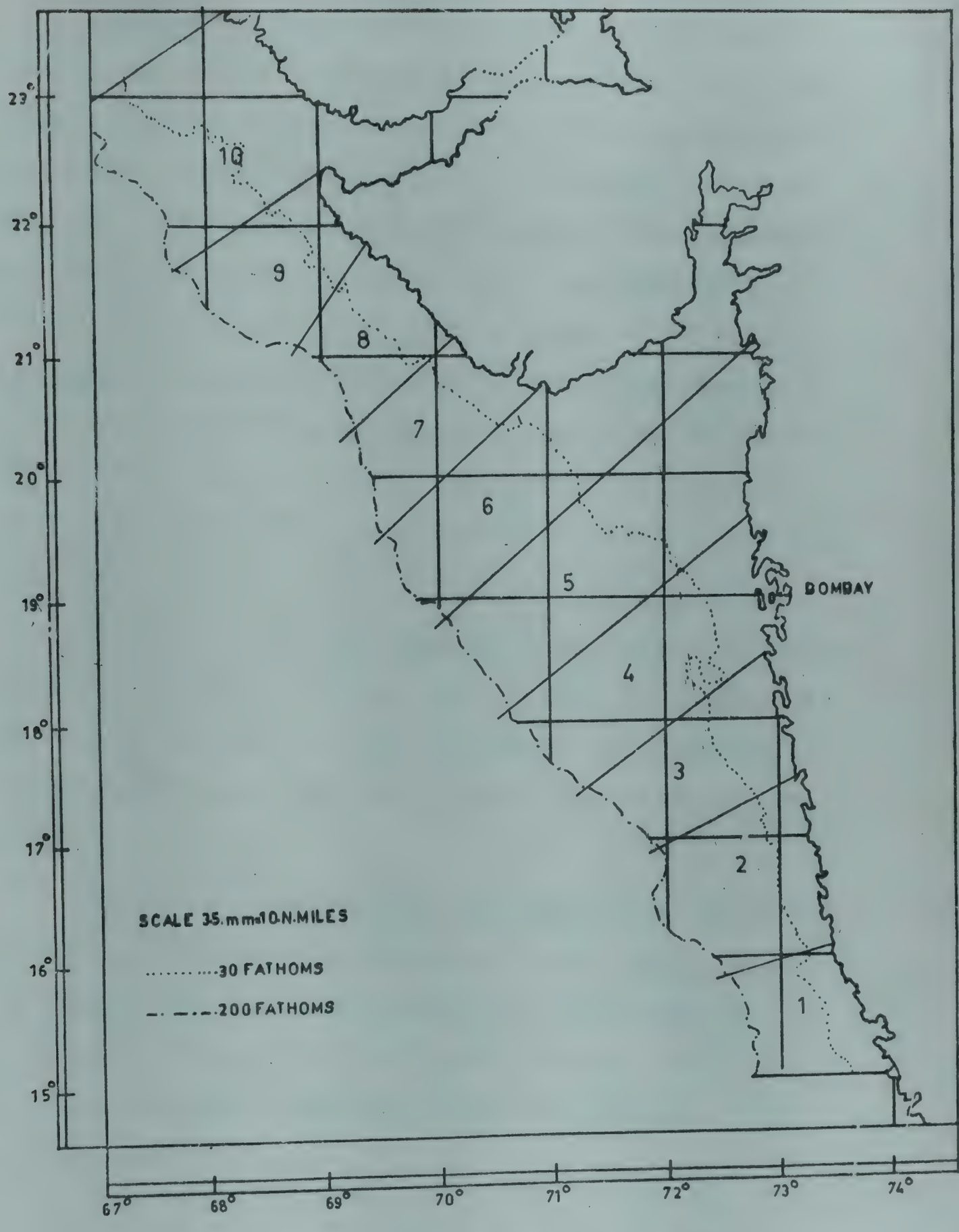


FIG:1. SAMPLING STRATA FOR PELAGIC FISH SURVEY

In order to obtain the best possible results of abundance estimations, special attention was given to the pelagic survey tactics/ selection of stations, modification of grid, nets etc. which were adjusted to the condition found in the investigated area, keeping the programme in view. The cruise tracts followed by M.T. Murena as per decisions taken at the pre-cruise meeting held on 14.2.77 are presented in Figs. 2 and 3. The distribution of bottom and pelagic trawl stations by M.T. Murena are also given in Fig. 4. At certain productive areas which have been located during the current voyage (details are presented elsewhere in this report) more effort were expended and the distribution of pelagic trawl stations in these areas are presented separately (Fig. 5).

The hydrological studies included observations on sea weather condition and determination of oxygen, salinity etc. The maximum depth for the Nansen bottle cast was 220 m. The plankton and bottom samples collected during the cruise were taken to shore laboratories for detailed analysis.

One of the supporting vessel viz. M.V. Blue Fin conducted both bottom and mid-water trawling operations whereas M.F.V. Meena Bharati operated only bottom trawls during this period. Blue Fin also collected hydrological data from selected stations. The distribution of trawl stations by these two vessels during Murena's second voyage are presented in Fig. 6.

RESULTS OF OPERATION OF M.T. MURENA

The programme of work decided upon on the pre-cruise meeting held on 14-2-77 was followed and accordingly M.T. Murena made 14 bottom trawl hauls in stratas 10 and 13 (Fig. 4 and 7) and 121 pelagic trawl/pelagic rope trawls in the entire area from 15° N to 24° N latitude. An estimated quantity of 242.5 tons of fish were landed during the entire cruise expending about 314 hours.

i. Bottom trawling: Out of the 14 hauls made, an estimated catch of 5,435 kg. was landed in 29.73 hours at a catch rate of 182.81 kg/hour. The strata-wise details of the hauls made are presented below for clarity.

Strata	No. of hauls	Depth of fishing (m)	Fishing effort (hrs)	Catch (kg)	Catch/hour (kg)
13	7	55-76	15.33	3,078	200.78
10	7	59-88	14.40	2,357	163.68
Total	14	55-88	29.73	5,435	182.81

Table I gives the areawise fishing effort, catch and catch/hour of operation by bottom trawling during Murena's second voyage. It is seen that out of four areas between 30-50 fathoms surveyed i.e. 18-71, 18-72, 19-71 and 19-72, the highest catch rate was recorded from area 19-71 with 199.17 kg/hour. Area 18-72 yielded the second highest catch rate with 194.25 kg/hour. The other two areas i.e. 18-71 and 19-72 yielded 159.60 and 140.17 kg/hour respectively.

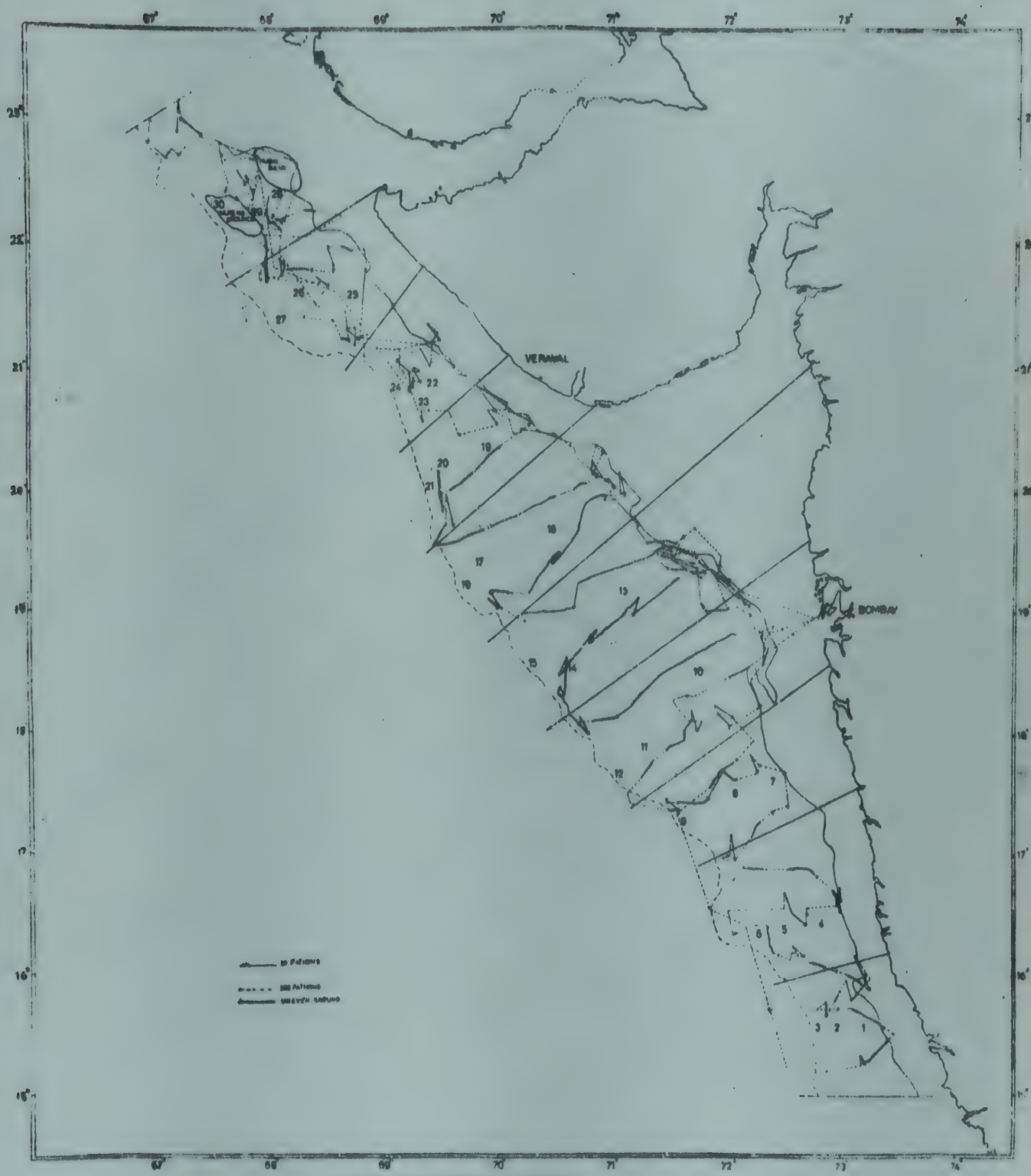


FIG 2 CRUISE TRACK - CRUISE NO.2 M.V. MURENA

FIG-3. M.T. MURENA CRUISE NO 2 AREA 25-30

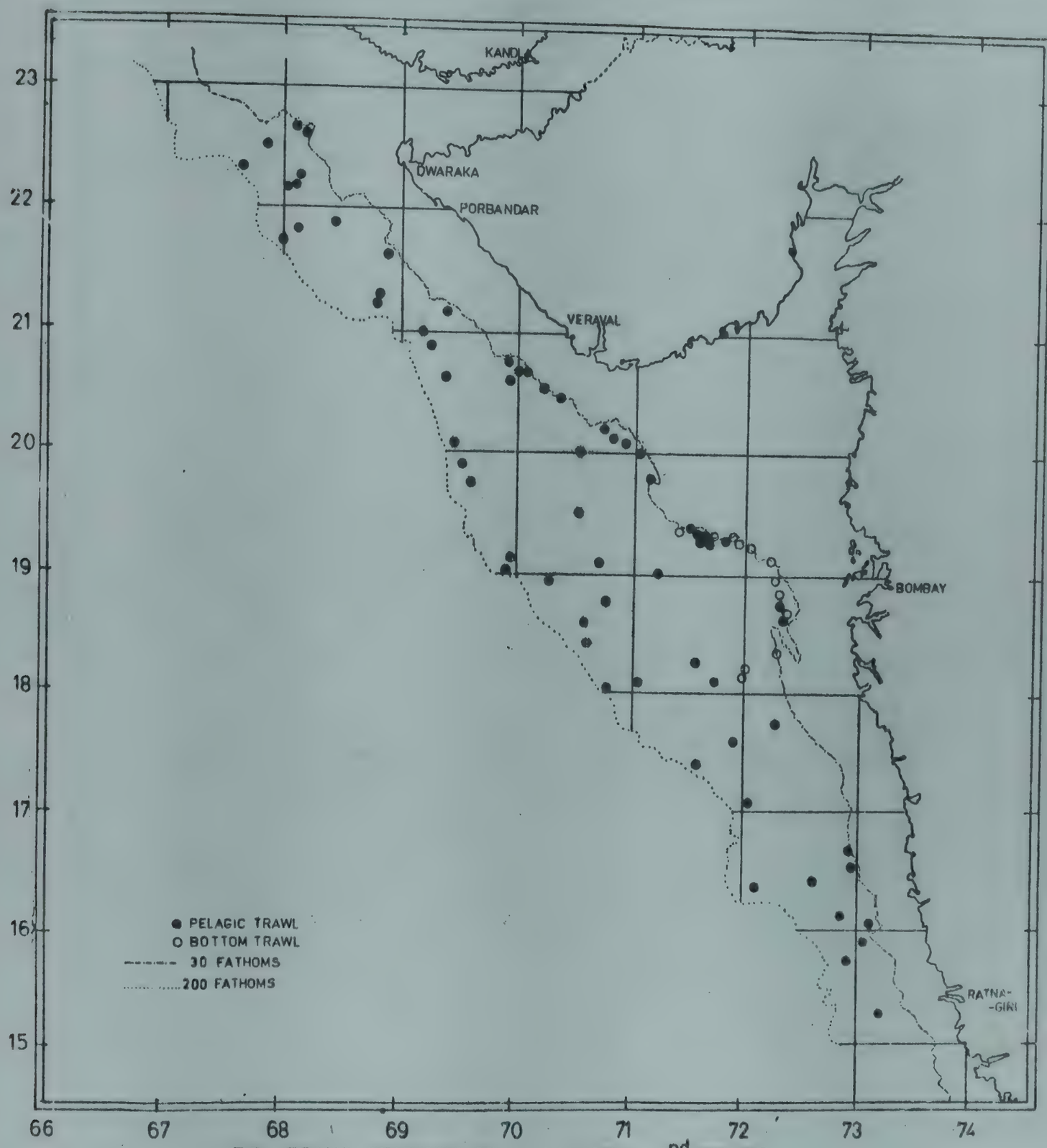


FIG:4. TRAWL STATIONS OF M.T. MURENA-2nd CRUISE

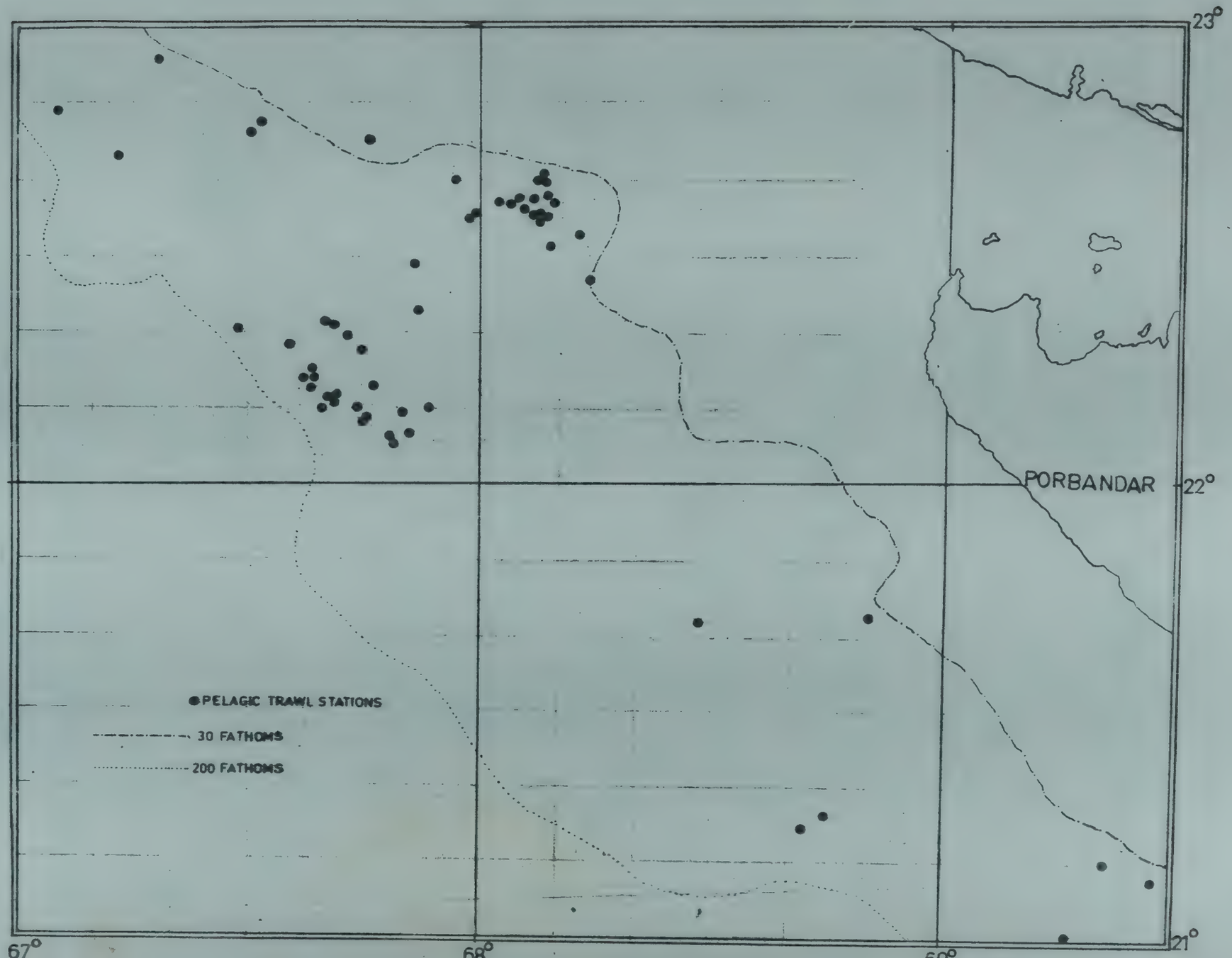


FIG:5 M.T.MURENA, DISTRIBUTION OF PELAGIC TRAWL STATIONS IN [illegible]

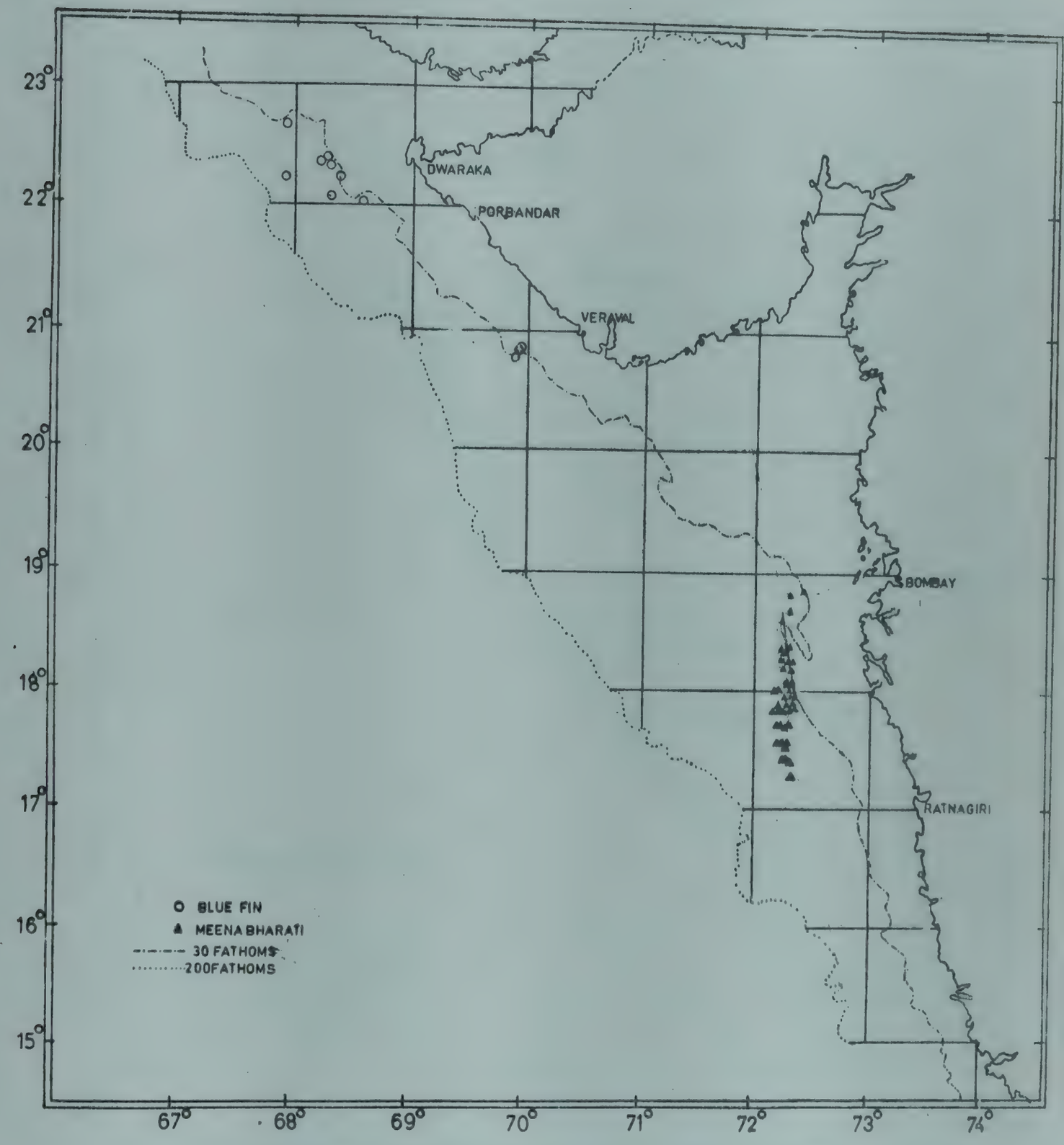


FIG:6.TRAWL STATIONS OF BLUE FIN & MEENA BHARATI

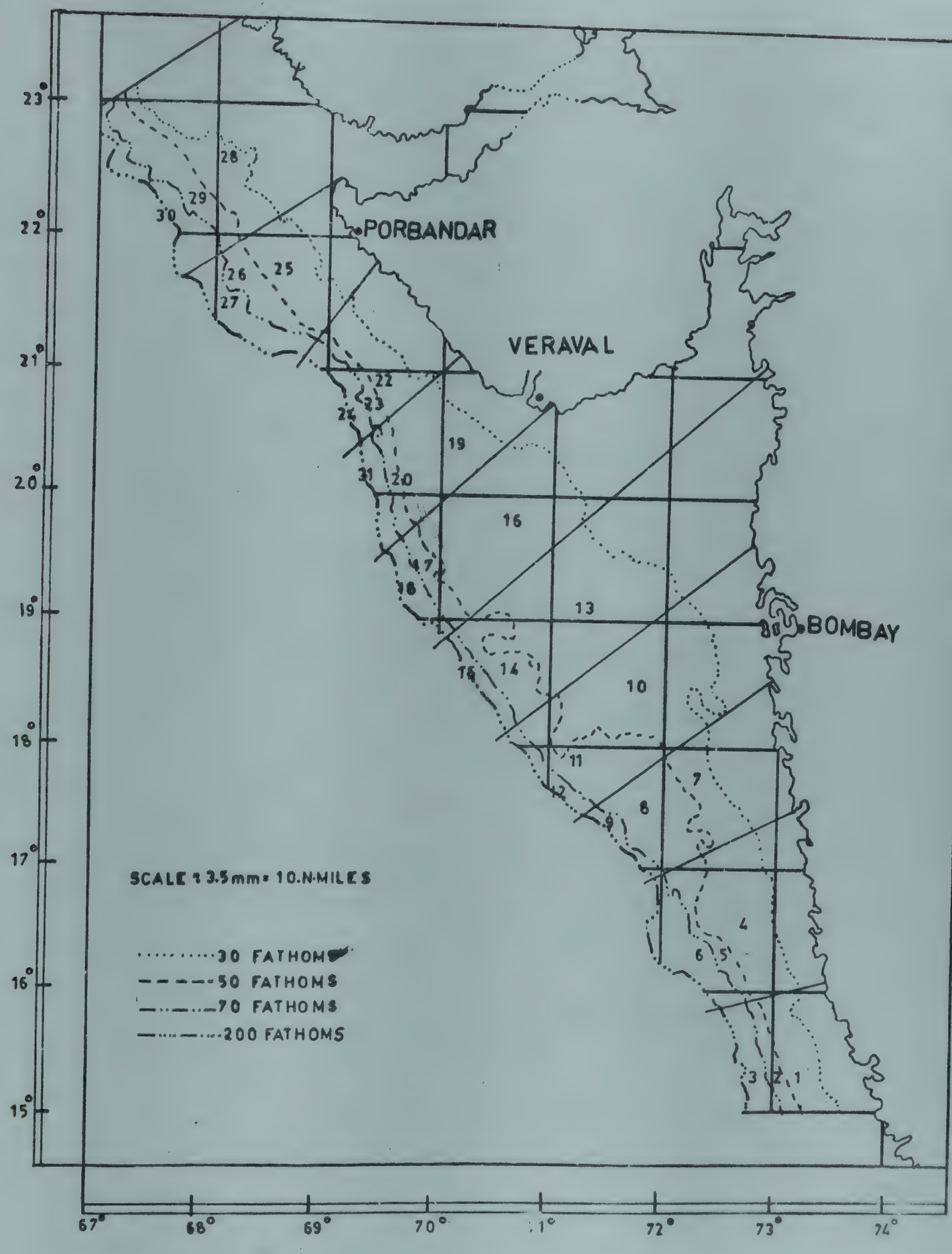


FIG.7. SAMPLING STRATA OF GROUND FISH SURVEY.

TABLE I Area-wise catch rates (kg/hour) of bottom trawling obtained by M.T. Murena during the second voyage

Area	Fishing effort (hrs)	Total catch (kg)	Catch/hour (kg)
18-71	2.50	399	159.60
18-72	8.00	1,554	194.25
19-71	13.33	2,655	199.17
19-72	5.90	827	140.17

Since this coverage was part of the incomplete work of the first cruise, it was felt necessary to incorporate details of the catch rates obtained during the current voyage along with that of the first cruise for all the areas surveyed along the North west coast (Table II). It was noticed that no major deviations from the conclusion on area-wise catch rates already arrived at in the first report has been noticed and the broad findings indicated therein are reproduced again. The highest catch rate viz. 666.3 kg/hour was obtained from 20-70 off Veraval. The area 22-68 off Porbandar yielded the second highest catch rate viz. 504.8 kg/hour. Three areas viz. 20-70, 22-68 and 20-71 yielded above 300 kg/hour and the catch rates below 100 kg/hour were from area 16-73, 17-71, 18-70, 19-69 and 20-69. It was also pointed out earlier that the results obtained from area 20-70 off Veraval and 22-68 off Porbandar were promising and that it will be useful to study these regions in greater detail during the subsequent cruises.

TABLE II Area-wise catch rates (kg/hour) of bottom trawling obtained by M.T. Murena during the first and second voyages (combined)

Area	Fishing effort (hrs)	Total catch (kg)	Catch/hour (kg)
15-73	12.91	1,312	101.5
15-72	7.17	1,582	220.6
16-73	3.67	350	95.3
16-72	16.58	3,000	180.9
17-72	12.17	2,945	241.9
17-71	13.00	1,216	93.5
18-72	9.58	1,875	195.7
18-71	4.83	1,189	246.1
18-70	10.59	478	45.1
19-70	5.33	892	167.3
19-71	21.81	4,259	195.0
19-72	5.92	827	139.2
19-69	7.77	489	62.9
20-69	13.08	1,240	94.8
20-71	2.58	939	363.9
20-70	9.01	6,004	666.3
21-68	12.67	3,653	288.3
21-69	4.92	1,011	205.4
22-68	6.25	3,155	504.8

The species composition, catch per hour and the percentages of each variety in the total catch of the 14 bottom trawl hauls are given in Table III. It is seen that clasmobranchs

formed the major component with about 24%. Eel and ghol formed next major categories with about 16% followed by cat fish (14%). The catch rate of elasmobranch was the highest with 43.63 kg/hour followed by eel, ghol and cat fish with 30.34 kg/hour, 29.63 kg/hour and 25.70 kg/hour respectively. The catch rates of pomfret and karkara were 8.41 kg/hour and 6.09 kg/hour respectively, whereas for ribbon fish the catch rate noted was only 4.81 kg/hour.

TABLE III Species-wise composition, catch rates and percentages of each variety in the total catch obtained from bottom trawl by M.T. Murena during the second voyage

Varieties	Bottom trawl		
	Catch (kg)	Percentage	Catch/hour (kg)
Elasmobranchs	1,297	23.86	43.63
Ribbon fish	143	2.63	4.81
Eel	902	16.60	30.34
Pomfret	250	4.60	8.41
Seer fish	15	0.28	0.50
Cat fish	764	14.06	25.70
Ghol	881	16.21	29.63
Karkara	181	3.33	6.09
Tam	22	0.40	0.74
Rawas	40	0.74	1.35
Dara	65	1.20	2.19
E. nigra	86	1.58	2.89
Dhoma	151	2.78	5.08
Shrimps	36	0.66	1.21
Chorinemus spp.	15	0.28	0.50
Caranx spp.	15	0.28	0.50
Loligo & Sepia	54	0.99	1.82
Others	518	9.52	17.42
T o t a l	5,435	100.00	182.81

ii. Pelagic trawling: A total of 121 pelagic trawl/pelagic rope trawl hauls were made during the second cruise. The details and description of trawl have already been given in Report No. 1 relating to Indo-Polish Industrial Fisheries Survey. The trawls as already stated can be operated from surface to bottom depending on fish concentrations. These gears have been operated in most of the areas surveyed except off Dwaraka from where large quantities of horse mackerel were caught which were more or less operated along the sea bed. It was also observed that the northern regions i.e. off Dwaraka, more fishing effort was also expended than other areas due to the abundant fish concentrations and location of prospective productive areas for future exploitation.

The ten zones (Fig. 1) into which the survey grid were divided for the pelagic survey were covered by 59 hauls which included 30 obligatory hauls (as specified in the pre-cruise meeting) and 29 extra hauls distributed in different zones. Another 62 hauls were also made in selected areas due to the abundant concentration of schools. Thus it is seen, that out of 121 pelagic trawl hauls made, the vessel landed an estimated catch of 2,37,058 kg in 284.19 hours. The catch/hour and the catch/hour/horse power in respect to pelagic trawling for Murena's second voyage worked out to 834.15 kg/hour and 0.512 kg respectively. The different strata zones allocation of sampling effort and the progress made during the second cruise are shown in Table IV.

TABLE IV Allocation of sampling effort at each zone by pelagic trawl and the progress made during second cruise of M.T. Murena

Zone	Area/Square Nautical miles	No.of hauls to be made	No.of hauls made	Fishing depth (m)	Catch (kg)
1.	2577	3	5	54 - 126	3,661
2.	4292	3	6	31 - 117	1,115
3.	3044	3	3	80 - 125	593
4.	5718	3	6	57 - 137	585
5.	5754	3	15	52 - 176	10,104
6.	5133	3	10	48 - 138	9,125
7.	3029	3	9	55 - 144	17,513
8.	1813	3	8	20 - 180	1,855
9.	3323	3	7	20 - 286	646
10.	3384	3	52	8 - 130	1,92,861
Total:	38,067	30	121	20 - 286	2,37,058

a) Relative abundance by area

In order to study the catch composition/catch rates etc. from the different regions, the area lying between 15° N latitude to 23° N latitude have been divided into six geographical regions as was done in Report No. 1. The broad divisions demarcated were as follows:

(1) Goa between latitude 15° to 16° N
(2) Ratnagiri between latitude 16° to 18° N
(3) Bombay between latitude 18° to 20° N
(4) Veraval between latitude 20° to 21° N
(5) Porbunder between latitude 21° to 22° N and
(6) Dwaraka between latitude 22° to 23° N

Table V shows the catch rates obtained by pelagic trawling during M.T. Murena's second voyage from the above mentioned six regions of the North west coast of India.

TABLE V Catch rates obtained by pelagic trawling during M.T. Murena's second cruise from 19-2-77 to 12-4-1977

Varieties	Goa	Ratnagiri	Bombay	Veraval	Porbandar	Dwaraka	Total
Elasmobranchs	17.0	13.2	31.5	37.3	7.0	61.2	41.5
Ribbon fish	9.1	20.3	96.5	287.2	19.1	185.0	149.5
Eel	0.5	-	69.6	19.1	-	1.8	16.2
Horse mackerel	-	7.5	37.2	18.4	4.3	1120.9	500.0
Pomfret	8.8	6.3	9.0	7.2	2.2	137.0	63.7
Seer fish	3.4	0.5	1.8	2.8	3.1	8.8	5.0
Cat fish	325.6	20.9	13.2	10.3	1.5	16.2	24.2
Ghol	-	-	7.2	8.9	0.3	2.0	3.9
Karkara	0.6	0.2	3.6	2.4	1.2	3.7	2.9
Tam	0.4	-	1.6	3.0	2.0	3.4	2.5
Rawas	-	-	2.0	-	-	-	0.5
Elacate nigra	-	-	5.7	-	-	-	1.2
Dhoma	-	-	0.5	7.9	-	0.1	1.4
Shrimp	-	-	1.2	0.4	-	0.2	0.4
Chorinemus spp.	0.2	-	0.6	3.9	1.3	4.8	2.9
Caranx spp.	13.9	0.9	0.9	1.0	0.7	0.5	1.2
Barracuda	-	0.3	-	1.0	0.6	0.8	0.6
Loligo & Sepia	-	-	-	-	-	0.3	0.2
Other quality fish	2.7	11.3	21.3	14.0	7.1	12.3	16.4
Total catch (kg)	3661	1708	19154	18503	1170	192862	2,37,058
Fishing effort (hrs)	9.58	20.99	63.13	43.56	23.22	12371	284.19
Catch/hour (kg)	382.2	81.4	303.4	424.8	50.4	1559.00	834.2

It can be seen that Dwaraka region yielded the highest catch rate of 1559 kg/hour and the second highest was noticed from Veraval i.e. 424.8 kg/hour. The lowest catch rate was recorded from Porbandar region with 50.4 kg/hour. Reference may be made here about the observations made during the ground fish survey conducted by M.T. Murena's first voyage, wherein the same trend of region-wise abundance was noticed i.e. Dwaraka yielding the highest catch rate with 505 kg/hour and the next best being Veraval with 332 kg/hour.

It was also noticed that there was considerable variation in catch rates of different varieties obtained from different regions. Distribution of some of the important categories of fish have been indicated below to illustrate the abundance in different regions.

ELASMOBRANCHS: The highest catch rate of 61 kg/hour was obtained from Dwaraka. Veraval and Bombay regions yielded 37 kg/hour and 32 kg/hour respectively whereas other regions yielded less than 20 kg/hour, lowest being 7 kg/hour from Porbandar. During the first cruise on ground fish survey, it may be stated that the highest catch rate in respect of elasmobranchs was obtained from Porbandar with 115 kg/hour.

RIBBON FISH: The highest catch rate obtained during the cruise was from Veraval with 287 kg/hour; Dwaraka yielded 185 kg/hour, Bombay 96.5 kg/hour and Ratnagiri 20 kg/hour. Other regions yielded less than 20 kg/hour. During the first cruise of ground fish survey the highest catch rate was also obtained from Veraval region with 106 kg/hour indicating a more or less similar trend of abundance.

EEL: Bombay region appeared to be comparatively good for this species with a catch rate of 70 kg/hour. Veraval yielded 19 kg/hour whereas other region appear to be negligible. This was in conformity with the earlier observation made during the first voyage of M.T. Murena.

HORSE MACKEREL: Dwaraka region yielded relatively high catch rate with 1121 kg/hour. Four other regions except Goa yielded between 4 to 37 kg/hour while Goa region did not encounter any horse mackerel in the landings during Murena's second voyage.

POMFRET: In the case of pomfret, the highest catch rate obtained was from Dwaraka region with 137 kg/hour. All the other region yielded less than 10 kg/hour. It is interesting to note that during the first voyage in bottom trawling, the highest catch rate for pomfret was recorded from Veraval with 13 kg/hour.

SEER FISH: Even though this species was found available in all the regions, the catch rates from Dwaraka (9 kg/hour) was found to be fairly higher than the other regions.

CAT FISH: As observed during the first cruise, this species was found abundant in the Goa region with 326 kg/hour and steadily decreased towards the northern regions. The rest of the regions, the catch rate of this category ranged from 10 kg/hour to 20 kg/hour except Porbandar where the rate was a meagre 2 kg/hour.

GHOL: During the second voyage, this species appeared to be more abundant in Bombay and Veraval regions, the later giving a rate of 9 kg/hour. The southern regions viz. Ratnagiri and Goa did not encounter any landings of ghol. A more or less similar pattern of distribution was also noticed during the first ground fish survey.

DHOMA: Compared to the first cruise, the catch rates of this category was very poor in all regions, Veraval region netting the highest with 8 kg/hour. It may be mentioned here that Dwaraka yielded 292 kg/hour during the first voyage in bottom trawling.

CARANX: The highest catch rate was recorded from Goa region with 14 kg/hour during the current voyage whereas in all the other regions, the catch rate recorded was very poor. Bottom trawl analysis for the first voyage indicated the highest catch rate from Porbandar with 32 kg/hour.

Shrimp was represented in meagre quantities from Bombay, Veraval and Dwaraka regions. However, the catch rate was very poor with the highest rate being only 1.2 kg/hour from Bombay. Dwaraka region yielded the highest catch rate for Chorinemus spp. with 4.8 kg/hour followed by Veraval with 4 kg/hour. Species like Barracuda, Loligo and sepia though represented in the catches, does not yield any appreciable quantity from any of the regions. Cuttle fish being of economic importance it is suggested that greater attention will be made during the subsequent voyages, since export of these products has since recorded a spectacular growth in recent times.

Table VI gives the fishing effort, catch and catch rates obtained from 20 geographical divisions surveyed during the second cruise of M.T. Murena by pelagic trawling. The highest catch rate of 1838 kg/hour was obtained from 22-67 off Dwaraka. The catch from this area constituted about 70% of the total estimated catch from all the 121 pelagic hauls made. It was further noticed that four areas viz. 19-71, 20-70, 20-71 and 23-67 yielded between 100 - 400 kg/hour; two areas 15-73 and 20-69 yielded between 400 - 600 kg/hour; one area 22-68 between 600 - 1000 kg/hour and one area 19-69 between 1000 - 1200 kg/hour. All the eleven remaining areas yielded less than 100 kg/hour.

TABLE VI Area-wise catch rates (kg/hour) obtained by pelagic trawling by M.T. Murena during the second voyage from 19th February, 1977 to 12th April, 1977

Area	Fishing effort (hrs)	Total catch (kg)	Catch/hour (kg)
15-73	7.75	3,628	468.13
15-72	1.83	33	18.03
16-72	10.66	1,019	95.59
17-72	4.42	363	82.13
17-71	5.91	326	55.16
18-71	6.66	392	58.86
18-72	3.25	173	53.23
18-70	7.83	496	63.35
19-71	33.48	10,796	322.46
19-70	6.00	573	95.50
19-69	5.91	6,724	1137.73
20-71	2.50	902	360.80
20-70	24.15	7,823	323.93
20-69	16.91	9,778	578.24
21-69	8.74	525	60.07
21-68	13.15	605	46.01
21-67	1.33	40	30.08
22-68	30.23	26,634	881.05
22-67	89.98	1,65,427	1838.49
23-67	3.50	800	228.57

During the second cruise, certain productive areas especially for horse mackerel and pomfret in depth of 60 m to 180 m between the latitude 22° to 23° N and longitude 67° to 69° E have been located which is of special importance. The catch on this ground varied between 5 to 15 tons per haul. The fishes caught from this ground were mainly horse mackerel of about 30 cm in length, besides ribbon fish, pomfret, cat fish, shark, ray etc. Further, it may be mentioned that the nattings of horse mackerel was done only at nights.

A table has been shown below to illustrate the magnitude of the catch per haul during the last week of March, 1977 in connection with Murena's second voyage.

Trawl No.	Catch (kg)	Trawl No.	Catch (kg)	Trawl No.	Catch (kg)	Trawl No.	Catch (kg)
67	5,000	73	800	79	5,000	85	3,058
68	5,000	74	5,870	80	Malfunction-	86	6,000
69	6,000	75	3,840	81	ing of net	87	6,000
70	5,000	76	8,000	82	100	88	8,000
71	12,000	77	15,000	83	5,000	89	7,000
72	8,000	78	5,000	84	12,000	90	15,000

Productive grounds for pomfrets were also located in strata 28, areas off Dwaraka between 30 - 50 fathoms and schools of this species were largely seen in concentration during early hours of the day. Another productive ground for eel (Wam) was also identified especially in strata 13, off Bombay between 30 - 50 fathoms depth zone. The location of 2-3 prospective productive grounds and the high catch rates recorded from the areas especially 22-67, 19-69 and 22-68 are highly encouraging and it will be useful to watch and study these regions during the subsequent voyages.

Figs. 8 and 9 indicate the catch rates obtained in 21 different areas of geographical distribution in respect of bottom trawling and pelagic trawling carried out by M.T. Murena for cruise Nos. I and II (all data combined). On a detailed scrutiny of Fig. 8 in respect of bottom trawling it is seen that only in one area viz. 22-68, the catch rate was more than 400 kg/hour and in two areas viz. 20-70 and 20-71, the yield ranged between 300-400 kg/hour. From Fig. 9 in respect of pelagic trawling it is seen that catch rates ranging from 1200 - 1600 kg/hour and 1000 - 1200 kg/hour were recorded only from one area each viz. 22-67 and 19-69 respectively. Area 22-68 yielded between 600 - 1000 kg/hour whereas areas 15-73 and 20-69 the catch rate ranged between 400 - 600 kg/hour. There were four areas i.e. 19-71, 20-71, 20-70 and 23-67 where the catch rates recorded ranged between 100 - 400 kg/hour. All the remaining areas yielded less than 100 kg/hou

Since the figures given under Figs. 8 and 9 are prepared based on data collected during Murena's 1st and 2nd voyages (Pooled data) and since four more voyages are contemplated during the year under this programme, the conclusion arrived at, can be termed as tentative since more information will be forthcoming in the subsequent voyages.

b) Composition of catch

Table VII shows the catch composition by pelagic trawling with the percentages in the total alongwith catch rates. List of commercially important species occurring along the North west coast of India are also given in Table VIII. It is seen that the bulk of the catch in pelagic trawls in the order of abundance were horse mackerel, Megalaspis, M. cordyla, ribbon fish, Trichiurus haumela, pomfret, Parastromateus niger, elasmobranchs, cat fish and eel.

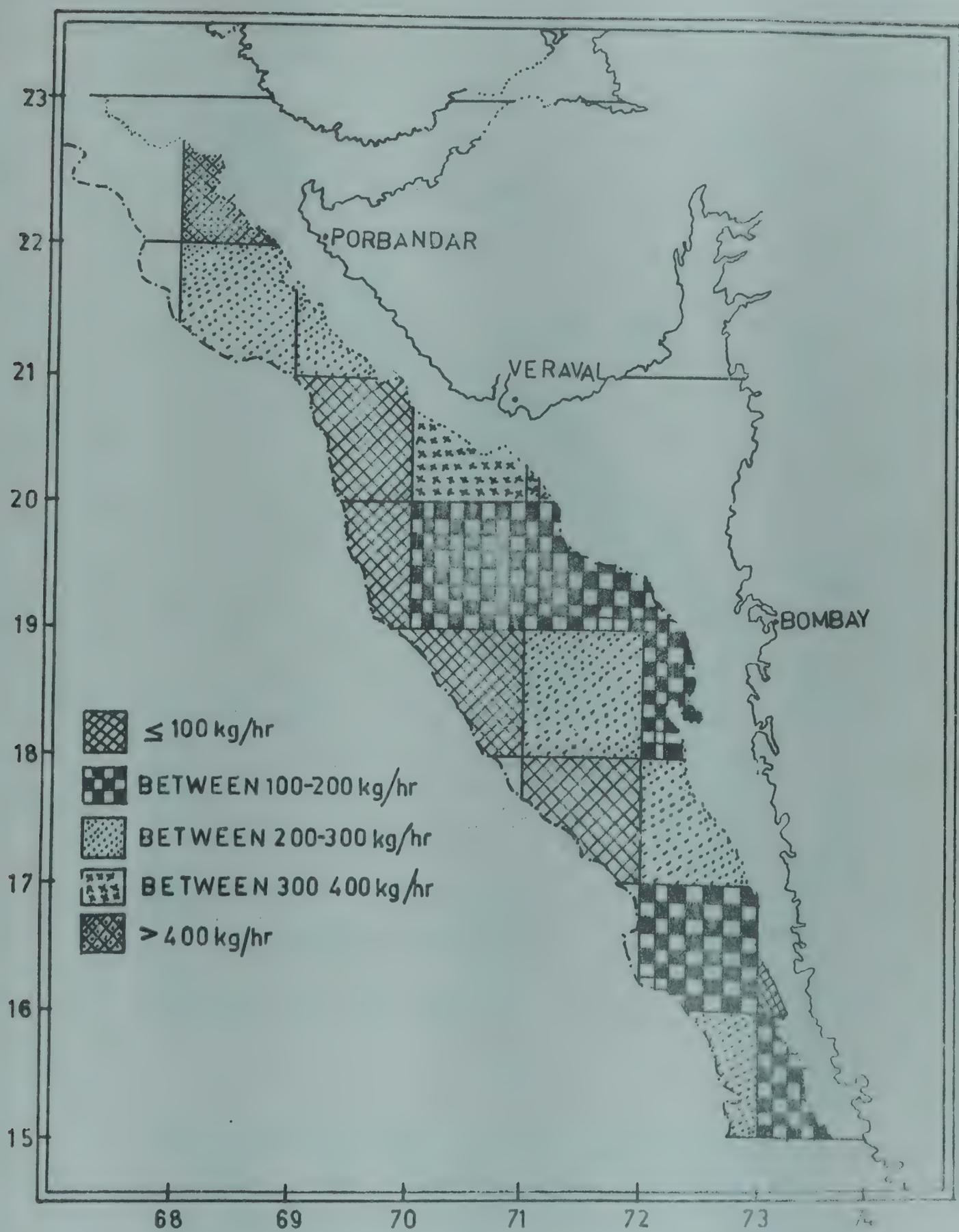


FIG.8 CATCH/HOUR OF BOTTOM TRAWLING OF M.T. MURENA BY AREA
(BASED ON FIRST & SECOND CRUISES)

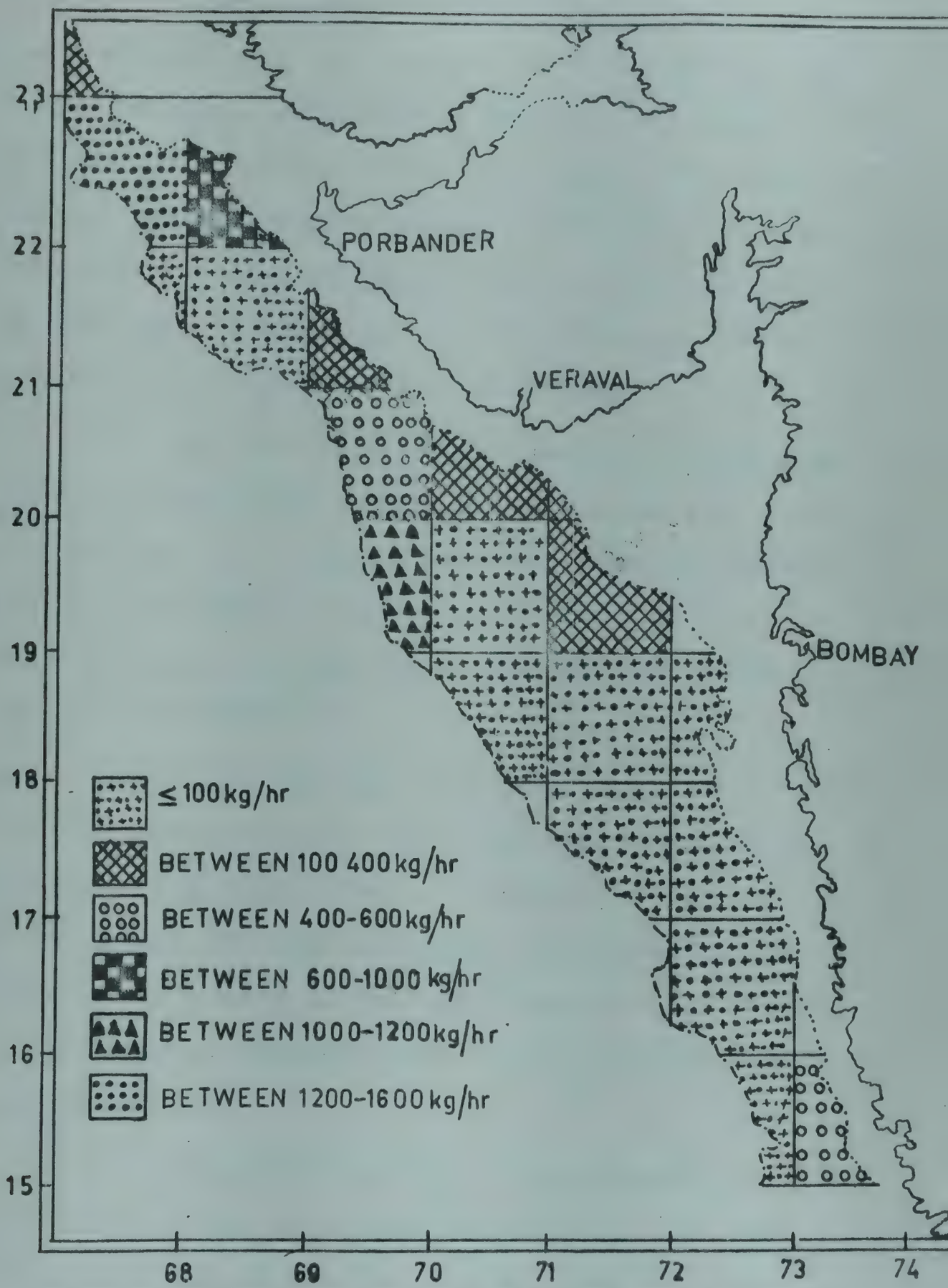


FIG9 CATCH/HOUR OF PELAGIC TRAWLING OF MT MURENA

(BASED ON FIRST&SECOND CRUISES)

Figs. 10 and 11 show the percentage composition of the important varieties of fish in the catch from the six different regions i.e. Goa, Ratnagiri, Bombay, Veraval, Porbandar and Dwaraka. Cat fish formed about 85% of the total catch from Goa region. The second predominant group was elasmobranchs and constituted by 45% of the total catch. Other major varieties were Caranx, ribbon fish and pomfrets. During the first cruise of M.T. Murena also this region was found to be very good for cat fish in respect of bottom trawling.

Cat fish and ribbon fish were found to be predominant in the catches from Ratnagiri region each constituting respectively about 25% of the total catch. Elasmobranchs stood in the next position with 16% while horse mackerel was constituted by 9% percent. In a few pelagic hauls made during the first cruise, shark and other quality fishes were also found abundant.

In Bombay region, ribbon fish and eel formed the bulk of the catch constituting about 32% and 23% respectively. During the first cruise of M.T. Murena by bottom trawling, ribbon fish was about 27% and eel about 8% of the total catch. The eel landings recorded from this area appear to be the highest compared to all the other regions. Other important varieties from the region were horse mackerel, pomfrets and elasmobranchs.

From Veraval, the bulk of the catches was constituted by ribbon fish with about 68% of the total catch. The next dominant variety was elasmobranchs with about 9% followed by eel and horse mackerel. During the first cruise by M.T.Murena in respect of pelagic trawling, ribbon fish, horse-mackerel, rays and dhoma were netted in the order of abundance whereas in bottom trawling ribbon fish and elasmobranchs were the dominant categories from this area.

In Porbandar, ribbon fish was again the predominant group constituted by about 38% of the total catch. Elasmobranchs formed 14% and was the second major variety. A few pelagic hauls were done in the same region during the first voyage and the main catch composition recorded were ribbon fish, horse mackerel, shark, skates and perches whereas for bottom trawling elasmobranchs and Caranx spp. were the major varieties obtained from this area.

Horse mackerel was the predominant variety in areas off Dwaraka constituting nearly about 72% of the total catch. Ribbon fish was the next major group with about 12% while pomfret and elasmobranchs were in the order of about 9% and 4% respectively. Sharks/skates, pomfrets and ribbon fishes were netted in the order of abundance during the first cruise of M.T. Murena whereas by bottom trawling dhoma was the predominant species from this region with about 58% of the catch. However, it may be mentioned that dhoma was found negligible during the present cruise.

Comparing all the six regions, the following points are outstanding :-

1) Cat fish which was a dominant species at Goa showed a gradual decline in abundance at Ratnagiri, Bombay and poorly represented at Veraval, Porbandar and Dwaraka.

2) Ribbon fish started increasing in abundance from Ratnagiri to Bombay and reached the peak at Veraval and later showed signs of decline towards northern regions.

3) Horse mackerel and pomfrets were found dominant at Dwaraka region.

4) The bulk of Wam catch came from Bombay compared to all the other regions, Porbandar being the second.

5) The recording of perch landings was good at Porbandar.

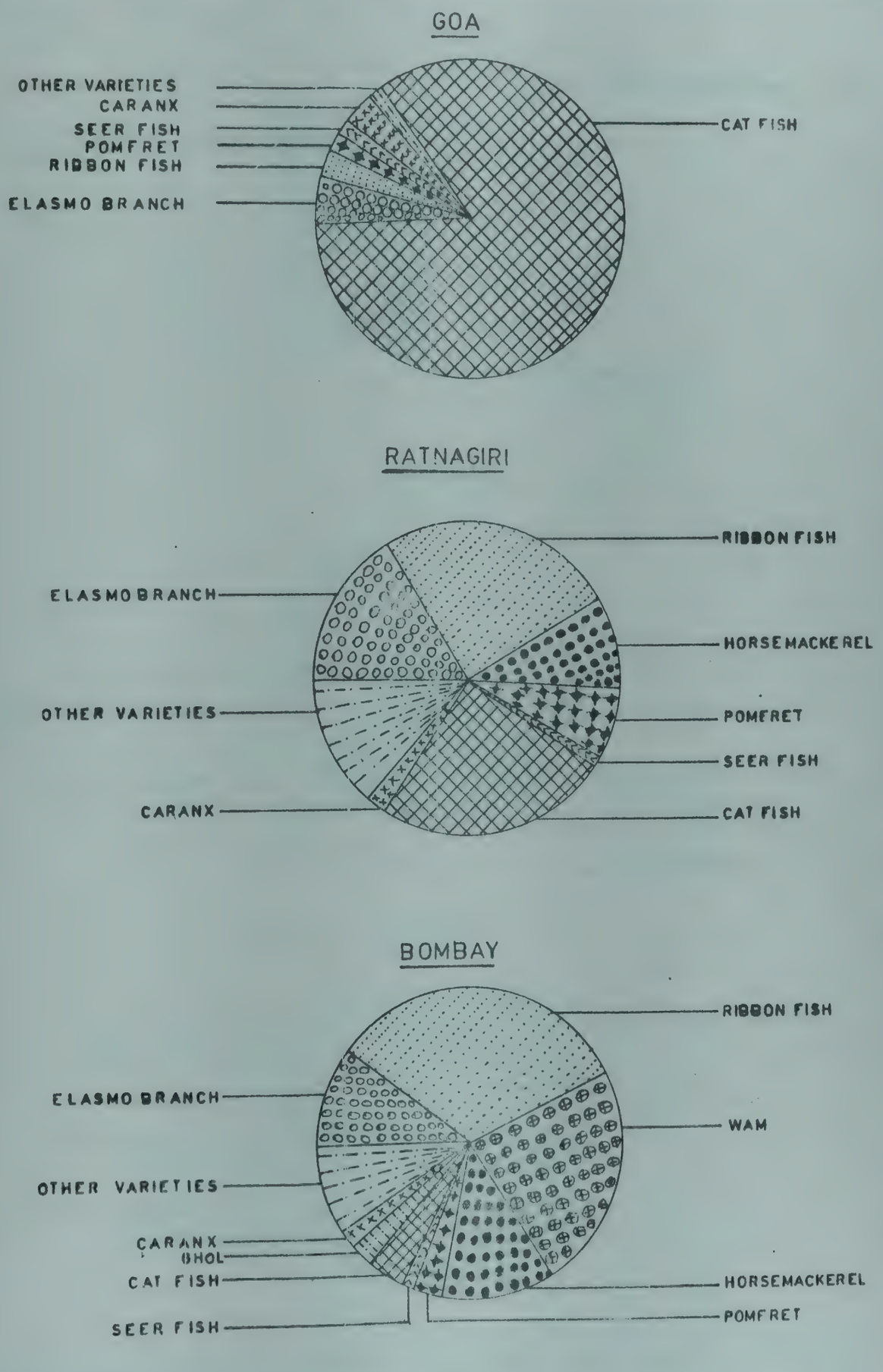


FIG 10 FISH CATCH COMPOSITION (%) OFF GOA, RATNAGIRI AND BOMBAY

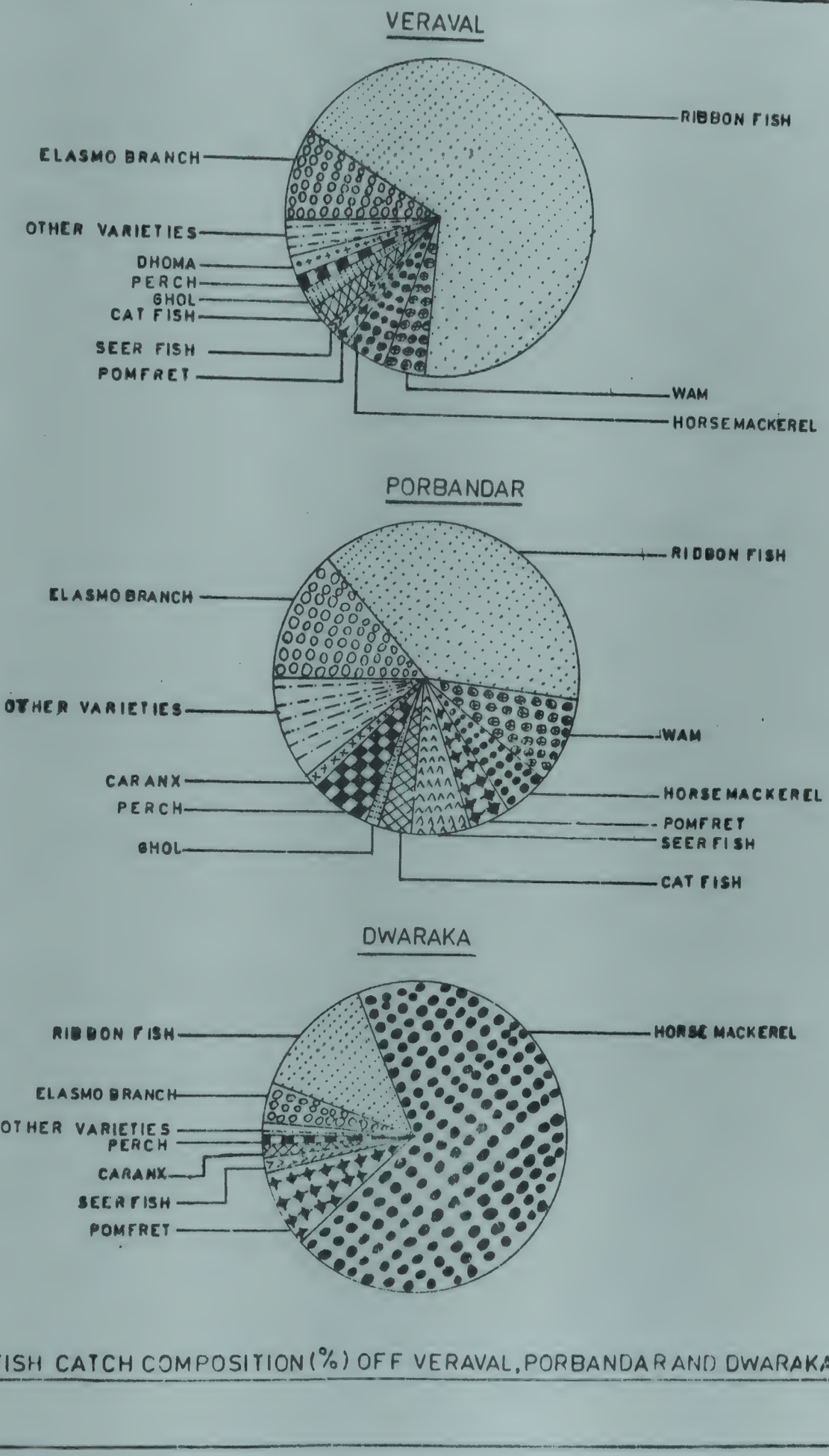


FIG:11. FISH CATCH COMPOSITION (%) OFF VERAVAL, PORBANDAR AND DWARAKA.

TABLE VII Species-wise composition catch rates and percentage of each variety in the total catch obtained by pelagic trawl hauls by M.T. Murena, during the second voyage

Species	Pelagic trawl		
	Catch (kg)	Percentage	Catch/hour (kg)
1. Elasmobranchs	11793	4.97	41.50
2. Ribbon fish	42496	17.93	149.53
3. Eel	5459	2.30	19.21
4. Horse mackerel	142086	59.94	499.97
5. Pomfret	18105	7.64	63.71
6. Seer fish	1438	0.61	5.06
7. Cat fish	6888	2.91	24.24
8. Ghol	1115	0.47	3.92
9. Karkara	827	0.35	2.91
10. Tam	705	0.30	2.48
11. Rawas	137	0.06	0.48
12. Dara	12	0.01	0.04
13. *E. nigra*	359	0.15	1.26
14. Dhoma	395	0.17	1.39
15. Shrimps	119	0.05	0.42
16. *Chorinemus* spp.	833	0.35	2.93
17. *Caranx* spp.	334	0.14	1.18
18. Barracuda	163	0.07	0.57
19. Loligo & Sepia	51	0.02	0.18
20. Others	3743	1.56	13.17
T o t a l :	2,37,058	100.00	834.15

TABLE VIII List of commercially important species occurring along the North west coast of India

Scientific name	Common English name	Local name
Scoliodon spp.	Shark	Mushi
Pristis spp.	Saw fish	Mali
Trygon and Raja spp.	Sting ray	Pakat
Anchoviella spp.	Anchovy	Kati
Chirocentrus dorab	Dorab	Karli
Trachysurus spp.	Cat fish	Shingada
Epinephelus spp.	Reef cod	Gobra
Lactarius lactarius	Butter fish	Pervi
Megalaspis cordyla	Horse mackerel	Karkatu Bangada
Caranx spp.	Trevelly	Kala Bangada
Chorinemus spp.	Leather skin	Dagol
Mene maculata	Moon fish	Chand
Lutianus argentimaculatus	Red snapper	Tambusa
Nemipterus japonicus	Thread fin bream	Rani fish
Leiognathus spp.	Silver belly	Khapi
Pomadasys maculatus	Spotted Grunters	Karkara
Trichiurus spp.	Ribbon fish	Wakti
Rastrelliger kanagurta	Mackerel	Bangada
Parastromateus niger	Black pomfret	Halva
Pampus argenteus	Silver pomfret	Saranga Paplet
Saurida tumbil	Lizard fish	Chor-bombil
Muraenosox spp.	Eel	Wam
Pseudosciaena spp.	Jew fish	Ghol
Johnius spp.	Croaker	Dhoma
Otolithoides spp.	Dori	Koth
Pellona spp.	White Bail	Kati

RESULTS OF OPERATION OF ANCILLARY VESSELS

(i) Meena Bharati

The vessel Meena Bharati conducted two voyages during the second cruise of M.T. Murena. She surveyed the areas 17-72 and 18-72 between the depth range 30-70 fms using bottom trawl expending about 122 hours of actual fishing effort, netted 28,875 kg. The average catch/hour and catch/hour/horse power for the entire period of operation was about 237 kg/hour and 0.90 kg respectively. The fishing effort, catch and catch/hour obtained from these areas are given below.

Area	Fishing effort (hrs)	Catch (kg)	Catch/hour (kg)
17-72	62.16	19029	306
18-72	59.50	9846	165
Total:	121.66	28875	237

It can be seen that of the areas covered by this vessel, the highest catch/hour viz. 306. kg/hour was recorded from area 17-72 off Ratnagiri. It was found necessary to pool the current data with that of Meena Bharati's 1st, 2nd and 3rd voyages and the relevant information gathered are presented in the ensuing table.

Area	Fishing effort(hrs)	Catch(kg)	Catch/hour(kg)
20-70	33.33	5,455	163.7
19-71	51.00	6,624	129.9
19-72	4.75	340	71.7
19-70	0.16	-	-
18-72	76.25	11,540	151.3
17-72	78.76	25,260	320.7
Total:	244.25	49,219	201.5

The highest catch rate was obtained from 17-72 off Ratnagiri with 320.7 kg/hour, the next best being 20-70 off Veraval with 163. 7 kg/hour. The average catch rate for the entire region from 1st to 5th voyage of Meena Bharati works out to 201.5 kg/hour.

Table IX furnishes the percentage composition of the important varieties obtained from the two regions surveyed, namely Bombay and Ratnagiri with comparative data during the last reporting (Report No.1). As can be seen from the Table that there is no significant difference noticed in the composition of the catch from these two regions except minor deviations.

TABLE IX Percentage composition of important varieties by region obtained by Meena Bharati with comparative figures during the last voyage

Varieties	Bombay		Ratnagiri		Total	
	Current voyage	Reproduced from Report No.1	Current voyage	Reproduced from Report No.1	Current voyage	Reproduced from Report No.1
Elasmobranchs	15.1	22.2	13.1	5.5	13.5	15.2
Cat fish	55.8	7.4	66.5	58.3	63.7	28.7
Perch	1.0	1.2	0.9	0.6	1.2	0.9
Ghol	1.0	4.2	1.1	0.6	0.7	2.7
Surmai	1.5	-	0.1	-	0.2	0.2
Dhoma	1.1	32.4	5.3	11.4	4.0	23.6
Pomfret	7.4	-	4.4	-	5.3	6.5
Rani fish	8.6	-	3.2	-	5.0	-
Wam	-	10.7	-	0.1	-	6.3
Koth	-	6.8	-	-	-	4.0
Miscellaneous	8.5	15.1	5.4	23.5	6.4	11.9

Analysing the data contained in Table IX in detail, it is seen that cat fish and elasmobranchs were predominant during the current voyage in Bombay region whereas during the last reporting, dhoma and elasmobranchs were netted in abundant quantities with eel and cat fish next in importance.

The percentage of cat fish has risen from 7.4% (reported in the 1st expedition) to 55.8% during the present survey which is of special significance. In Ratnagiri the netting of cat fish were slightly more during the current voyage (66.5%) than that of the previous one with 58.3%.

Elasmobranchs also recorded an increase at Ratnagiri from 5.5% to 7.4% from last reporting to the current voyage, whereas dhoma appears to have shown a decline. It is of interest that dhoma with 32.4% during the last reporting at Bombay has decreased considerably and a meagre quantity of 1.1% was netted.

Meagre quantity of Surmai was recorded during the current cruise at both the regions and complete absence of Wam and Koth was witnessed in Bombay region during the current period.

Table X gives the catch rates of important varieties of fish obtained from different geographical areas during the current cruise. Comparing the catch rates obtained for different varieties at the two areas surveyed, it is seen that the catch rates of cat fish recorded the highest i.e. 92.4 kg/hour in 18-72 (Bombay region) and 203.7 kg/hour in 17-72 (Ratnagiri region). Catch

rates of pomfrets recorded at both the regions were more or less similar while that of elasmobranchs a higher catch rate was seen in Ratnagiri region than that of Bombay but a reverse proportion was witnessed in the case of Rani fish (Nemipterus Japonicus).

TABLE X Catch per hour of important varieties of fish in different areas obtained by Meena Bharati during the current cruise

Varieties	Areas	
	18-72	17-72
Elasmobranchs	24.9	40.3
Cat fish	92.4	203.7
Perch	1.8	2.7
Ghol	1.6	3.2
Surmai	1.0	0.3
Dhoma	1.8	16.2
Pomfret	12.3	13.1
Rani fish	14.2	9.8
Miscellaneous	15.0	16.7
T o t a l	165.0	306.0

Table XI gives the catch rates of important varieties of fish from different geographical division based on Meena Bharati's 1st to 5th voyages (all data combined).

TABLE XI Catch per hour of important varieties of fish in different areas based on voyage Nos. 1 to 5 of Meena Bharati

Varieties	Areas				
	20-70	19-72	19-71	18-72	17-72
Prawns	-	-	0.2	-	-
Elasmobranchs	78.3	-	32.4	23.04	36.20
Pellona spp.	6.6	-	0.1	-	0.32
Chirocentrus sp.	3.0	-	4.3	0.79	1.15
Cat fish	0.6	16.8	0.3	79.32	207.24
Wam	2.5	11.6	17.0	0.09	0.10
Perch	3.5	-	1.8	1.22	3.11
Karkara	0.5	-	0.2	0.77	0.78
Ghol	8.5	3.2	6.8	1.30	3.09
Dhoma	35.6	23.2	50.3	3.16	21.89
Sciaenids	9.8	-	11.6	-	-
Ribbon fish	2.7	-	0.6	1.98	-
Pomfrets	5.2	-	1.2	10.58	20.97
Surmai	0.3	-	0.2	0.73	0.57
Squids	-	-	-	10.03	0.88
Other quality fish	6.8	16.8	2.9	18.35	25.03
T o t a l	163.9	71.6	129.9	151.36	321.33
Catch/hour/horse power	0.63	0.27	0.50	0.58	1.23

Comparing the different areas in detail, it was observed that the area 17-72 recorded highest catch rate with 321.33 kg/hour, next being 20-70 with 163.9 kg/hour. The catch/hour/horse power recorded in areas 17-72 and 20-70 were 1.23 kg and 0.63 kg respectively. Further, it was noticed that from areas 18-72 and 17-72, the important categories

netted with comparatively high catch rates were cat fish, elasmobranchs and pomfret whereas in areas 19-71 and 19-72 the dominant groups were dhoma, and cat fish. On the other hand, the catch rate of elasmobranchs and dhoma were high in respect of area 20-70. It may be emphasized that more detailed informations are necessary before arriving at any definite conclusions and hence further effort may be made during the subsequent voyages to cover more wider and distant areas in the area of investigation.

(ii) Blue Fin

The vessel Blue Fin conducted one voyage lasting for 12 days during the second voyage of M.T. Murena. The vessel left Cochin on 22.3.77 and after finishing the survey arrived at Bombay on 2-4-77. During the six fishing days from 26-3-77 to 31-3-77 in the area of investigation, she made eleven hauls i.e. 4 mid-water and 7 bottom trawl hauls. Since the Sonar had developed serious defects then, further attempts of mid-water trawling was discontinued. A total of 8337 kg was landed, effort expended being 11.64 hours, the average catch rate for the entire period of operation worked out to 716.2 kg/hour. The details of fishing effort expended, catch and catch rates obtained from areas 22-68, 22-67, 20-70 and 20-69 were as follows:

Area	Fishing effort (hours)	Catch (kg)	Catch/hour (kg)
22-68	6.56	6697	1020.9
22-67	1.08	38	35.2
20-70	2.50	183	73.2
20-69	1.50	1419	946.0
Total:	11.64	8337	716.2

Of the above four areas, 22-68 yielded the highest catch rate (1021 kg/hour). However, since the effort put in was very meagre in all the areas investigated, no definite conclusion could be arrived at.

For better assessment it was found necessary to pool the data obtained earlier for the first two voyages (Report No.1) along with the current cruise to illustrate the areas so far surveyed by Blue Fin and the catch rate obtained from different areas explored.

In the case of this vessel, the area 22-68, off Dwaraka yielded the highest catch/hour viz. 1020.9 kg/hour the second best being 228.8 kg/hour at 16-73.

Table XIII shows the percentage composition of important species obtained from Veraval and Dwaraka regions. The catch/hour of important varieties obtained from different areas based on 1st to 3rd voyage of Blue Fin combined are presented in Table XIV for comparison. It was indicated in the earlier report based on the first two voyages of Blue Fin that cat fish and rani fish recorded high catch rates in Goa and Ratnagiri regions whereas the catch rate showed a declining tendency towards northern regions. On the other hand, perches presented a reverse picture with Veraval area getting the maximum catch rate.

TABLE XII Pooled data on fishing effort, catch and catch per hour from different areas based on voyages 1 to 3 of Blue Fin

Area	Fishing effort (hours)	Catch (kg)	Catch/hour (kg)
15-72	4.33	118	37.3
15-73	18.33	2034	111.0
16-72	17.58	1828	104.0
16-73	4.83	1105	228.8
17-72	5.00	252	50.4
20-69	20.33	2282	112.3
20-70	15.00	1588	105.9
22-67	1.08	38	35.2
22-68	6.56	6697	1020.9
Total	93.04	15,942	171.35

TABLE XIII Percentage composition of important species in different regions based on Blue Fin's 3rd voyage

Varieties	Veraval Areas 20-69 & 20-70	Dwaraka Areas 22-67 & 22-68
Elasmobranchs	30.27	49.29
Lactarius	4.49	2.90
Carangids	2.81	3.71
Ghol	15.11	25.24
Perches	1.12	-
Miscellaneous	46.20	18.86

TABLE XIV Catch/hour (Kg) of important varieties in different areas by Blue Fin based on 1st & 3rd voyage.

Area	Fishing effort	CATCH COMPOSITION												Catch/ hour.
		Shark & Skate (Elasmo-branchs)	Rays	Wam	Perch	Carangids	Ranifish	Ribbon fish	Cat fish	Cephalopods	Horse-mackerel.	Pomfret	Other quality fish.	
15-72	4.33	-	-	-	6.0	-	10.4	-	1.4	3.9	-	-	5.5	37.2
15-73	18.33	8.7	0.5	0.2	7.1	1.0	35.1	6.6	38.5	3.4	-	-	9.9	111.0
Sub-total off Goa	22.66	7.0	0.4	0.1	6.9	0.8	30.4	5.3	31.4	3.5	-	-	10.0	94.9
16-72	17.58	0.9	0.5	3.3	14.9	1.1	26.3	2.6	46.5	4.7	-	-	3.2	194.0
16-73	4.83	0.8	0.8	-	-	1.9	1.0	1.2	216.6	3.1	-	-	3.3	228.7
17-72	5.00	0.6	0.4	-	6.4	0.8	40.0	0.8	0.8	0.6	-	-	-	50.4
Sub-Total off Ratnagiri.	27.41	0.8	0.5	2.1	10.9	1.2	24.7	2.1	69.0	3.7	-	-	2.1	117.7
20-69	20.33	1.3	26.3	1.5	5.6	4.3	-	21.2	4.8	-	0.2	1.7	45.5	112.4
20-70	15.00	1.0	2.9	5.9	52.3	2.1	-	18.3	0.5	-	-	0.3	22.6	105.9
Sub-total off Veraval.	35.33	1.2	16.4	3.4	25.4	3.4	-	20.0	3.0	-	0.1	1.1	35.7	109.7
22-68	5.66	-	586.6	-	-	44.7	-	-	-	-	-	-	552.5	1183.8
22-67	0.75	-	-	-	-	-	-	-	-	-	44.0	-	6.7	50.7
Sub-total of Dwarka	6.41	-	517.9	-	-	39.5	-	-	-	-	5.1	-	488.6	1051.1

SUMMARY AND GENERAL REMARKS

The results of operation of the second cruise of M.T. Murena and the supporting vessels, Meena Bharati and Blue Fin conducted under the Indo-Polish Industrial Fisheries Survey Programme have been analysed and presented in this report. 121 pelagic hauls and 14 bottom trawls hauls were made and landed an estimated quantity of 242.5 tons of fish expending about 314 fishing hours. The average catch per hour of bottom and pelagic trawling worked out to 189 kg/hour and 834 kg/hour respectively. 17 tons of fish meal was produced on board utilising a part of the catch.

Out of the four areas surveyed by bottom trawling between 30-50 fathoms, areas 19-71 and 18-72 yielded 199.17 kg/hour and 192.25 kg/hour respectively. Catch composition revealed that elasmobranchs formed the major component with eel and ghol forming the next major categories followed by cat fish.

Catch rates obtained by pelagic trawls from twenty geographical divisions revealed that the highest rate (1838 kg/hour) was recorded from 22-67 off Dwarka followed by 1137 kg/hour from 19-69 off Bombay and 881 kg/hour from 22-68 off Dwarka. The bulk of the pelagic trawls were horse mackerel (59.94%) ribbon fish (17.93%) pomfret (7.64%), elasmobranchs (4.97%) cat fish and eel. The catch composition from different regions indicated that Dwarka appeared to be very productive for horse mackerel (1121 kg/hour), pomfret (127 kg/hour) and elasmobranch (61 kg/hour). The moderately high catch rates for eel (70 kg/hour) and cat fish (326 kg/hour) were recorded from Bombay and Goa regions respectively. Ribbon fish (287 kg/hour) was found to be predominant in the catches from Veraval region. Comparing the catch composition from different regions, it is seen that cat fish, a dominant species at Goa, showed a gradual decline in abundance at Ratnagiri and Bombay and poorly represented at the northern regions. On the other hand, ribbon fish showed an increase in abundance from Ratnagiri to Bombay and netted high values at Veraval and

further declined towards northern sectors. Horse mackerel and pomfret were the dominant varieties at Dwarka whereas the bulk of wam and perch landings came from Bombay and Porbunder regions respectively.

Combining the data for the Ist and IInd voyages of M.T. Murena certain interesting observations have been brought forward: (i) For bottom trawling, area 22-68 recorded the catch rate above 400 kg/hour and two areas 20-70 and 20-71 recorded between 300-400 kg/hour (ii) For pelagic trawling, areas 22-67, 19-69, 22-68 recorded catch rates ranging from 1200-1600 kg/hour, 100-1200 kg/hour and 600-1000 kg/hour respectively. Areas 15-73 and 20-69 the catch per hour obtained were between 400-600 kg/hour.

Certain productive areas for horse mackerel in depth 60m to 180m between 20°- 23°N latitude and 67°- 69°E longitude, in area 22-67 has been located (Strata No.29). The catch on this ground which is netted only during nights varied between 5 to 15 tons per haul. Another productive grounds for pomfrets was also located in area 22-68 (Strata No.28) off Dwarka between 30-50 fathoms and schools of this species were largely noticed in concentration during early hours of the day. Another productive ground for eel was also identified especially in area 19-71 (Strata No.13) off Bombay between 30-50 fathom depth zone.

The location of 2-3 prospective productive grounds and the high catch rates recorded by pelagic trawl hauls especially in areas 20-68, 22-67, 19-69, 15-73 and 20-69 are highly encouraging and it will be useful to watch the prevailing situations in these regions during the subsequent voyages.

The results of the 2nd cruise has clearly demonstrated that along the North West Coast of India, there is ample scope for mid-water trawling. It would be useful to examine in detail the introduction of pelagic rope trawl from the new boats which are to be operated by Govt. of India and private agencies under different schemes.

Further, it has also demonstrated that intensive and successful fishing depended upon the efficient maintenance and utilisation of electronic equipments on board the vessel. Due consideration will have to be given on these aspects while formulating new programmes/schemes during the coming years.

Fishes which have a market demand were frozen on board the vessel in cartons, each carton weighing 28-30 kg. These cartons were suitably packed and could be exported or marketed locally depending upon the requirements. This method is certainly an improvement on the existing conditions in marketing and storage.

Since the fish meal produced on board the vessel is of a high protein content and is free from silica, it was suggested as an experimental measure to try production of fish meal after deheading and degutting in order to try this as a raw material for use by the pharmaceutical concerns. However, this needs further examination.

The supporting vessel Meena Bharati conducted two voyages during the second cruise of M.T. Murena. She surveyed the areas off Bombay and Ratnagiri from 30-70 fathoms using bottom trawls expending about 122 hours, netted 28,875 kg. The average catch/hour and catch/hour horse power for the entire period of operation was 237 kg/hour and 0.90 kg. respectively. Out of the two areas surveyed, the highest catch rate 306 kg/hour was obtained from 17-72 off Ratnagiri. Further, it was observed that the cat fish recorded the highest value i.e. 92.4 kg/hour in 18-72 and 203.7 kg/hour in 17-72. Catch rates of pomfrets recorded at both the regions were comparatively poor while that of elasmobranchs a higher catch rate was seen in Ratnagiri than that of Bombay, but a reverse proportion was witnessed in the case of rani fish, Nemipterus Japanicus.

Blue Fin - another supporting vessel conducted only one voyages covering the areas off Veraval and Dwarka, netting a total of 8,337 kg. in 11.64 hours, the average catch rate for the entire period of operation worked out to 716.2 kg/hour. Out of four areas surveyed 22-68 yielded high catch rate with 1021 kg/hour, second best being 946.0 kg/hour in area 20-69. While pooling the data so far obtained by the three voyages done by Blue Fin so far, the area 22-68 off Dwarka yielded the highest catch/hour with 1020.8 kg/hour the second best being 946 kg/hour in 20-69.

A D D E N D A

FISHES CAUGHT ALONG THE NORTH WEST COAST OF INDIA DURING INDO-POLISH SURVEY PROGRAMME.

Under the Indo-Polish Industrial Fisheries Survey the vessel M.T. Murena and two supporting vessels started operating from Bombay since January, 1977 between 15°N and 24°along the North West coast of India. The vessels have collected valuable data on the fishery resources between the depth range of 30-200 fathoms. A large number of different types of fishes have been identified and sorted out. Since the industry and organizations dealing with exploitation and marketing of fish from this area desire to know the scientific, English and Local names of the different species it was felt necessary for their convenience to present the diagrams of these fishes along with their scientific, english and local names as a ready reckoner for the identification of the different species available around the North West coast of India.

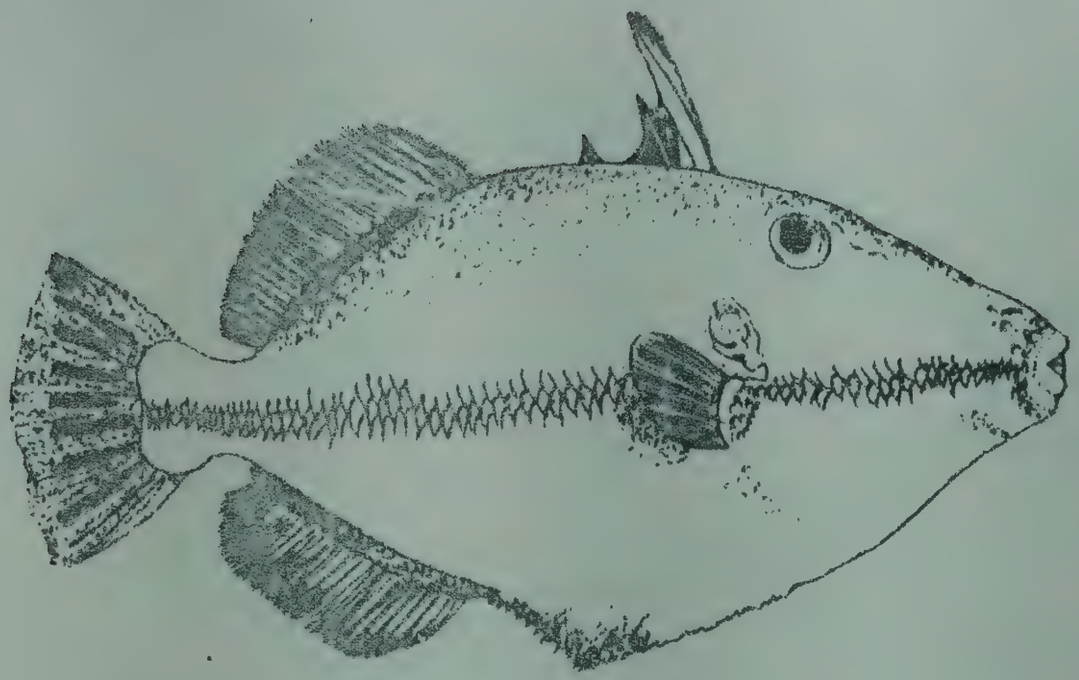
It is hoped that more information about the average size of fishes caught, areas of their concentration, their movements and the distribution of commercial fishery will be gathered during the current programme and will be furnished separately. The authors wish to thank Shri R. Selvaraj, Artist of Exploratory Fisheries Project, Bombay, for his keen interest in the work.

ARIUS CAELATUS ENGRAVED CATFISH

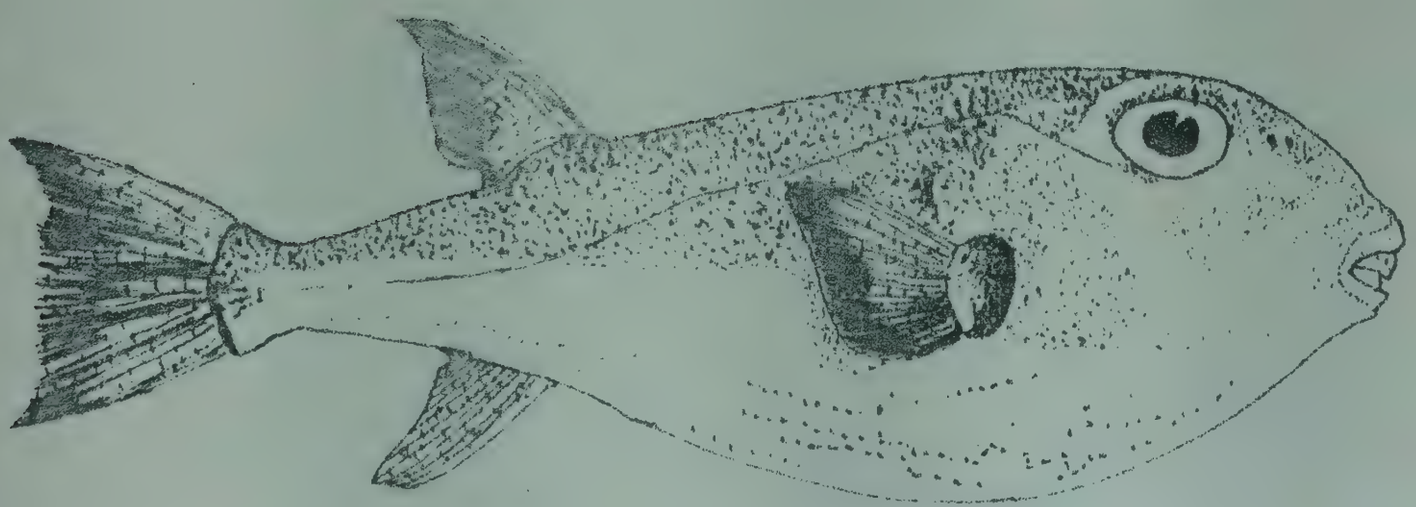
ARIUS MACULATUS SPOTTED CATFISH

ARIUS THALASSINUS GIANT CATFISH

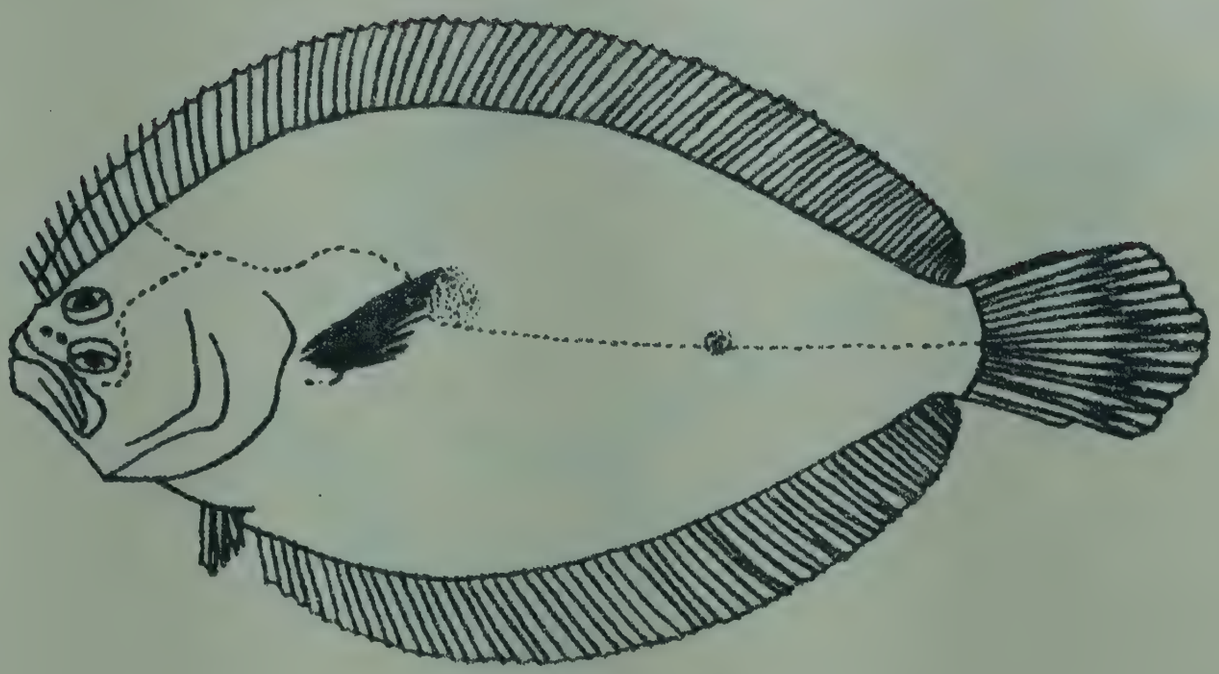
OSTEOGENIOSUS MILITARIS SOLDIER CATFISH



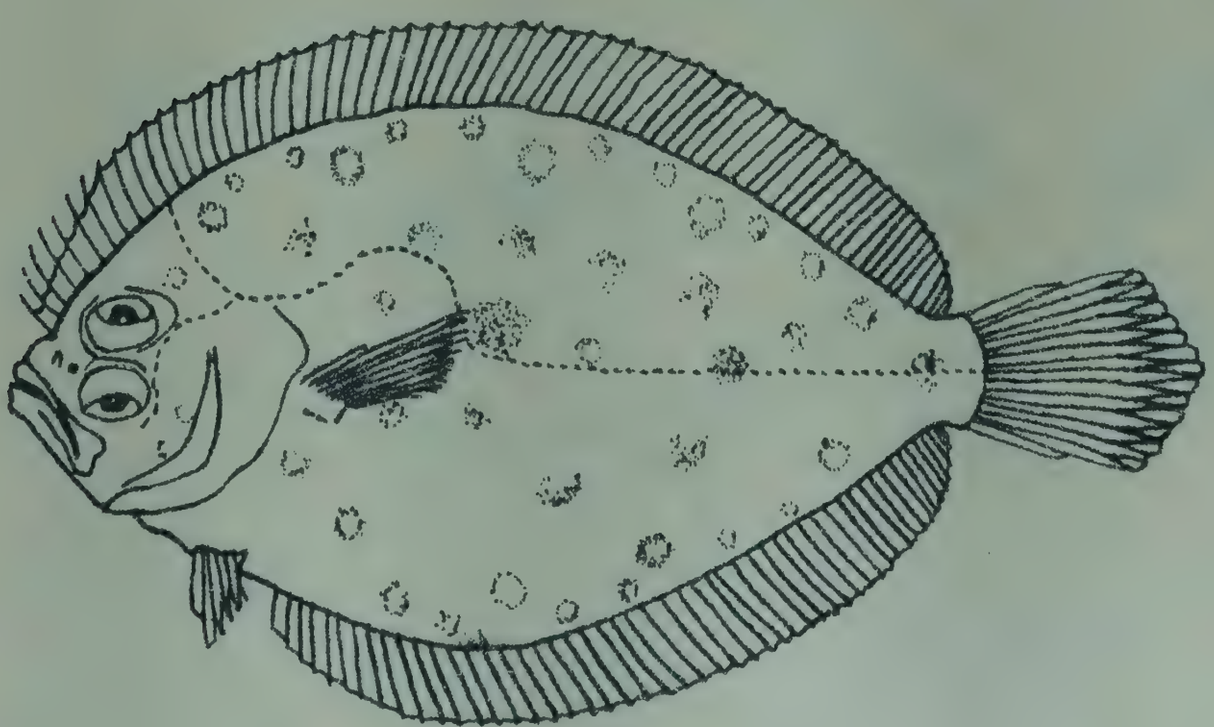
BALISTES NIGER



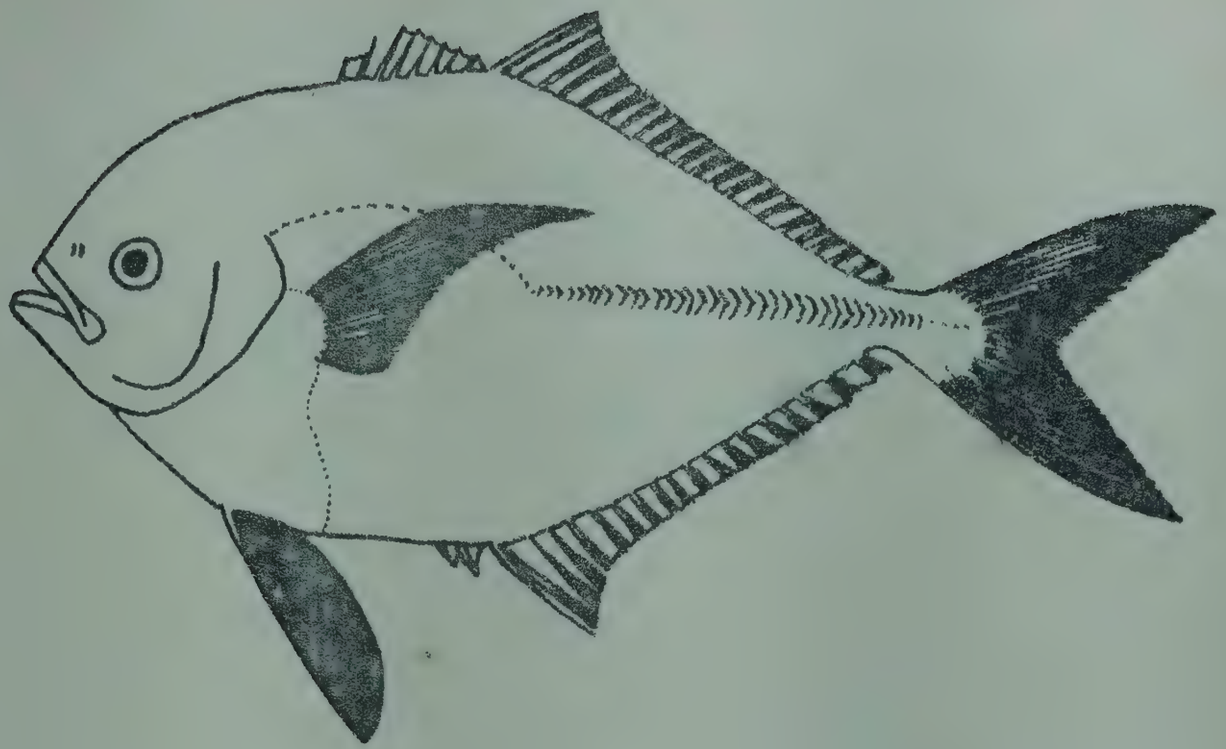
TETRODON INERMIS PUFFER FISH



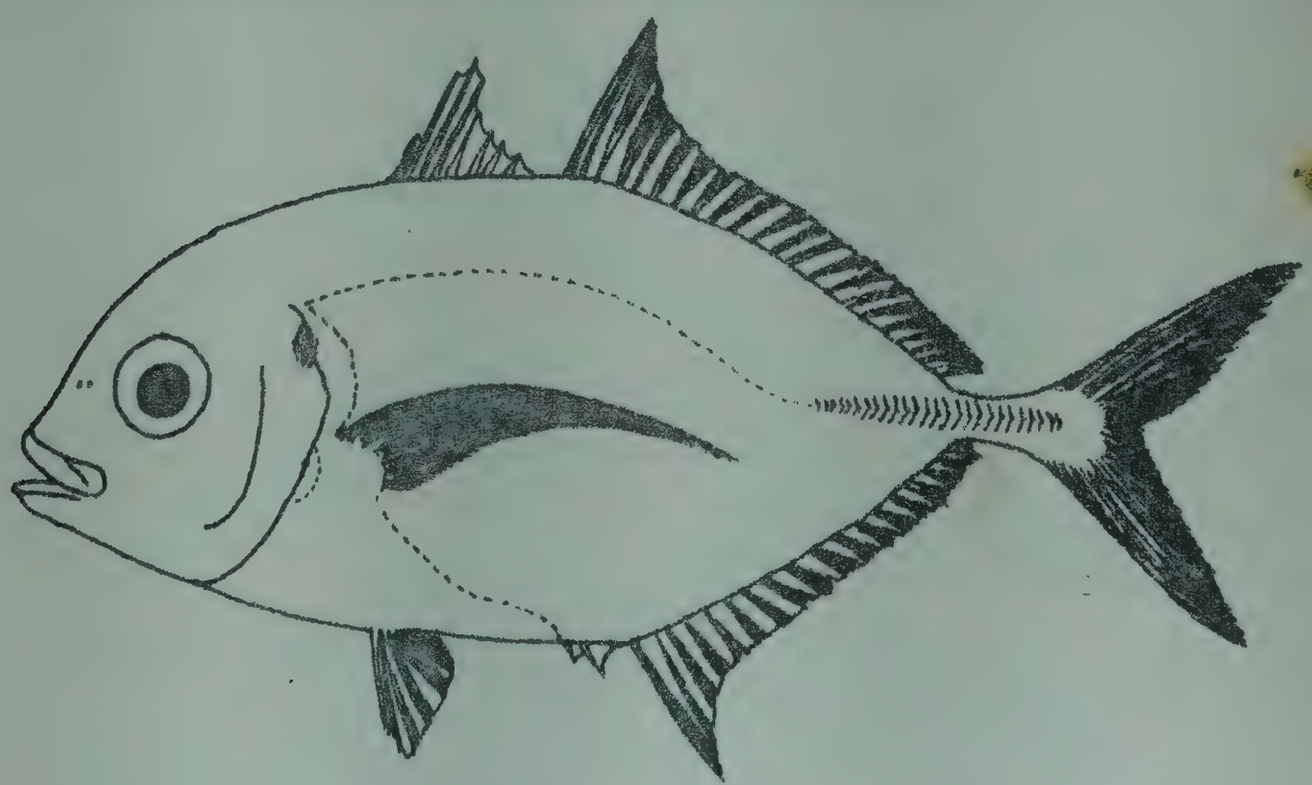
PSEUDORHOMBUS ARSITUS LARGETOOTH FLOUNDER



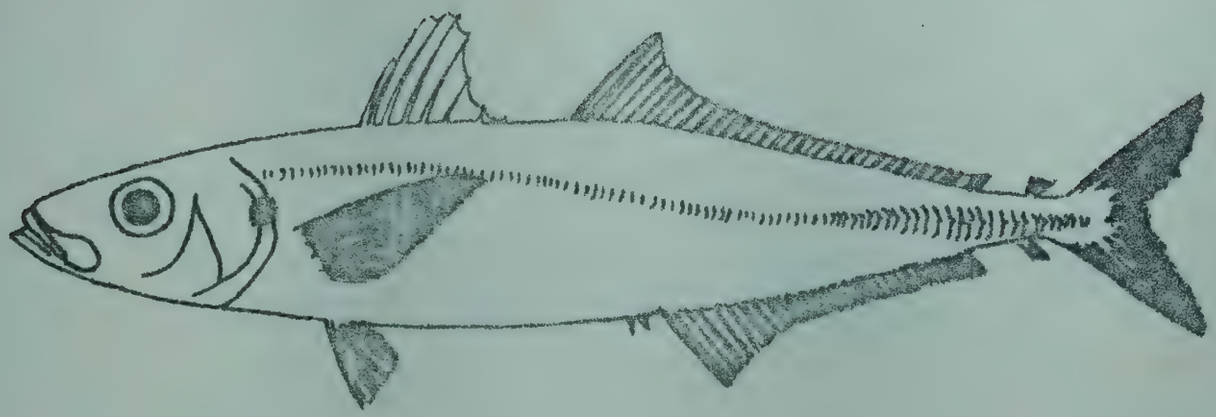
PESUDORHOMBUS ELEVATUS DEEP FLOUNDER



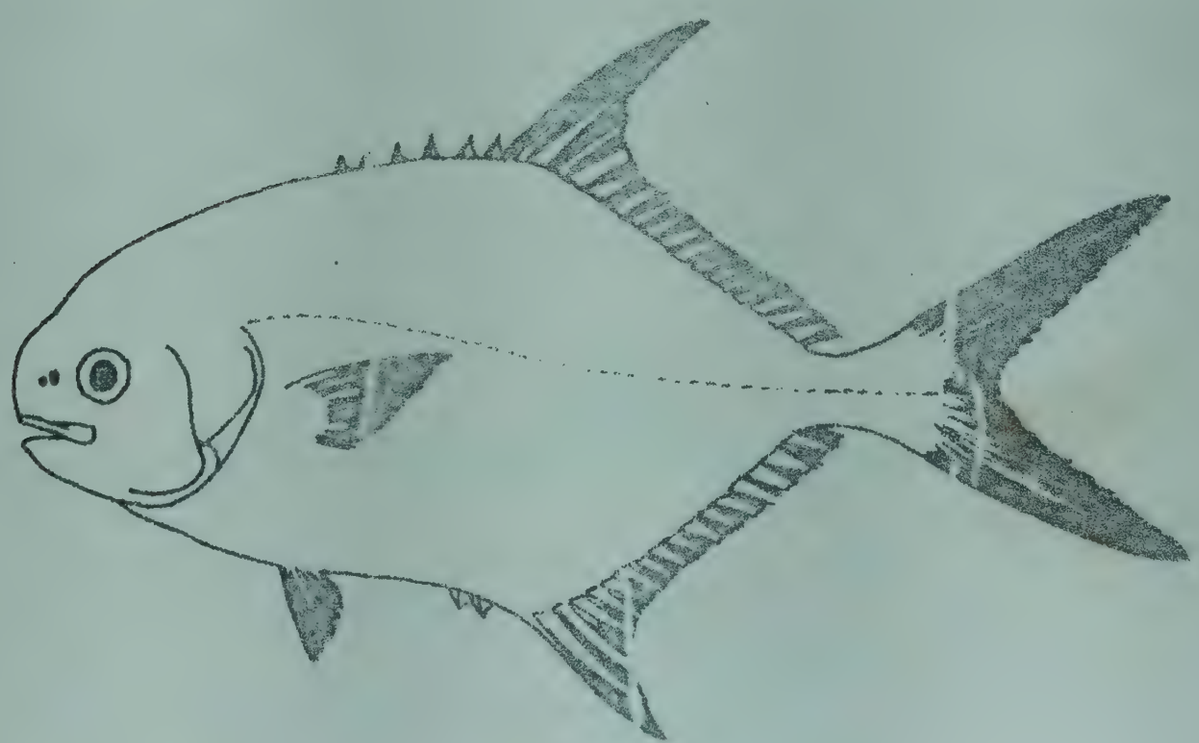
ATROPUS ATROPUS — KUWCH TREVALLY



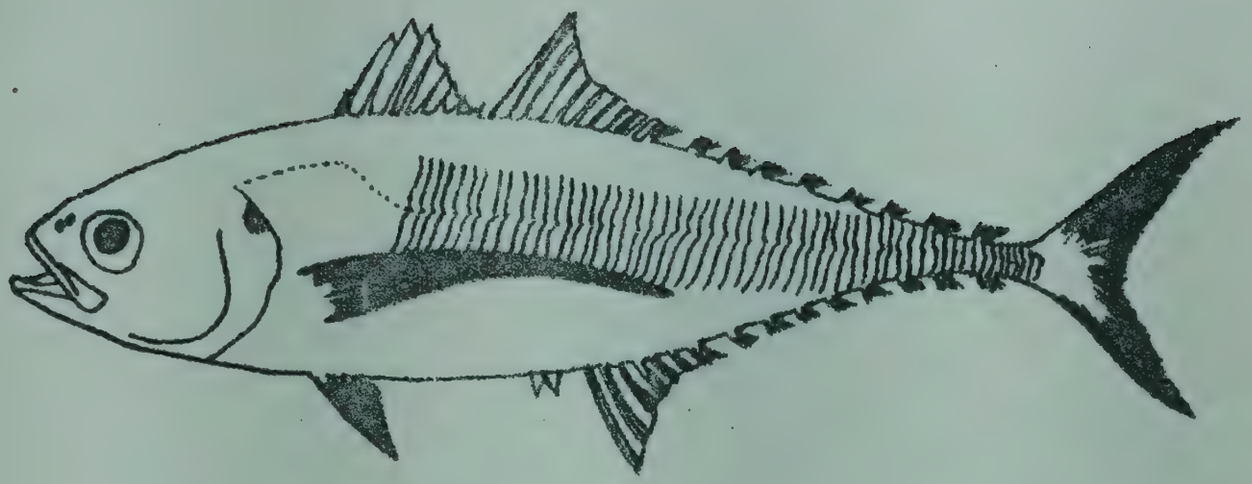
CARANGOIDES MALABARICUS — MALABAR CAVALLA



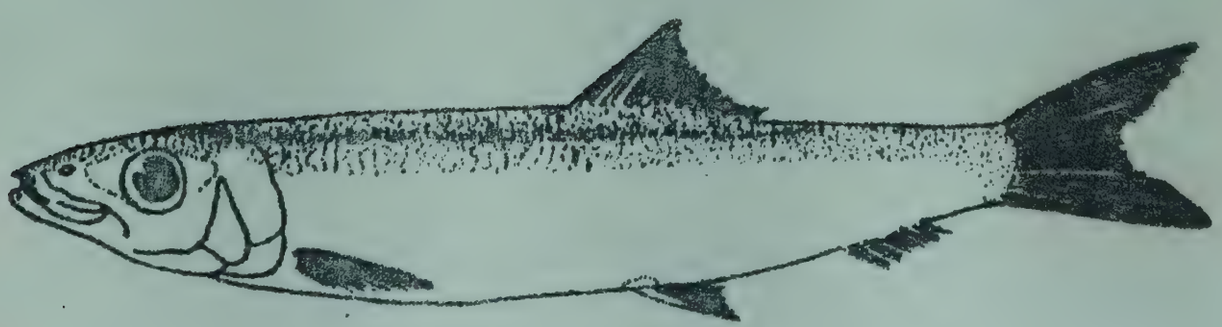
DECAPTERUS MACROSOMA. LAYANG SCAD



TRACHINOTUS BLOCHII SNUBNOSE POMPANO



MEGALASPIS CORDYLA KARKATU BANGADA HORSE MACKEREL



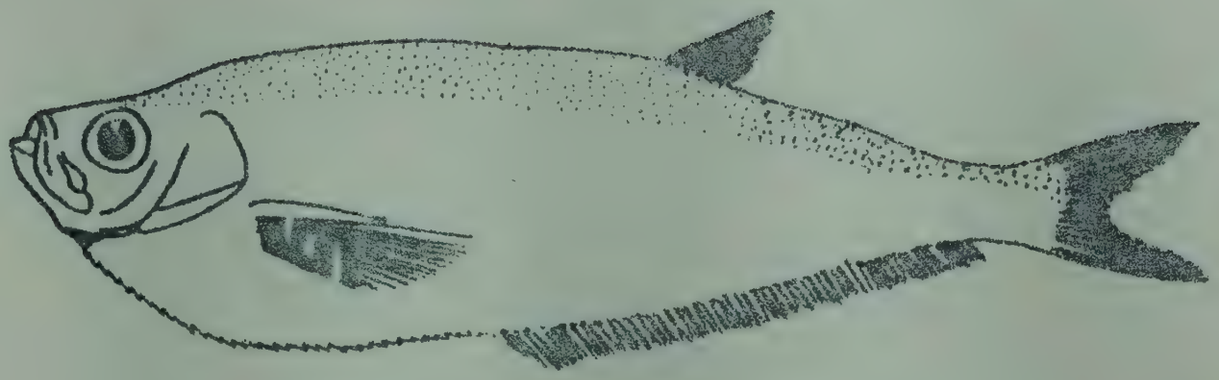
DUSSUMIERIA ACUTA MANDELI ANCHOUY

CHIROCENTRUS DORAB KARLI DORAB

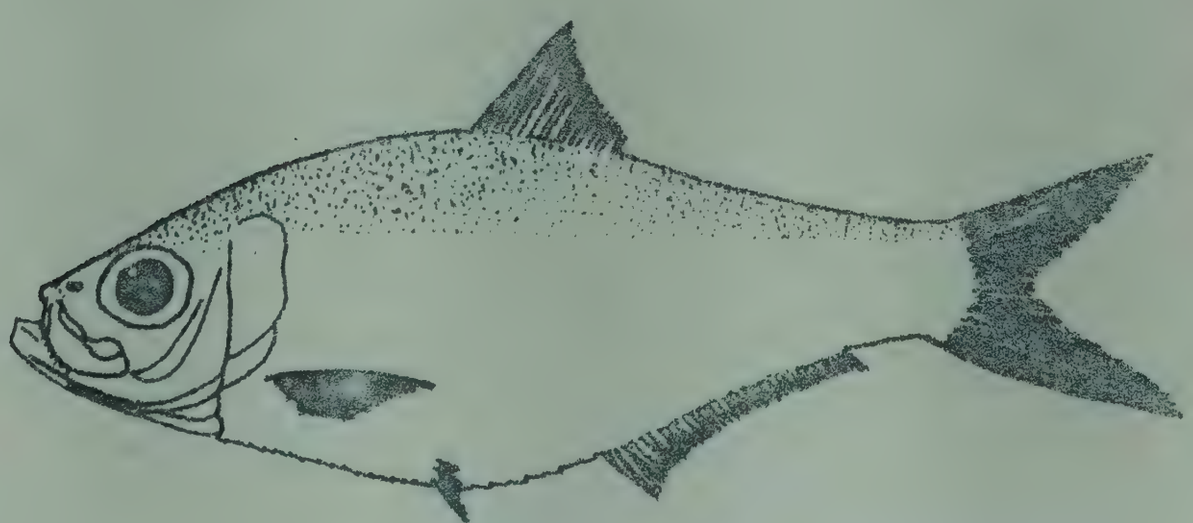
CHIROCENTRUS NUDUS KARLI DORAB

HILSA TOLI BHING GIANT HERRING

LISHA ELONGATA PALA INDIAN SHAD

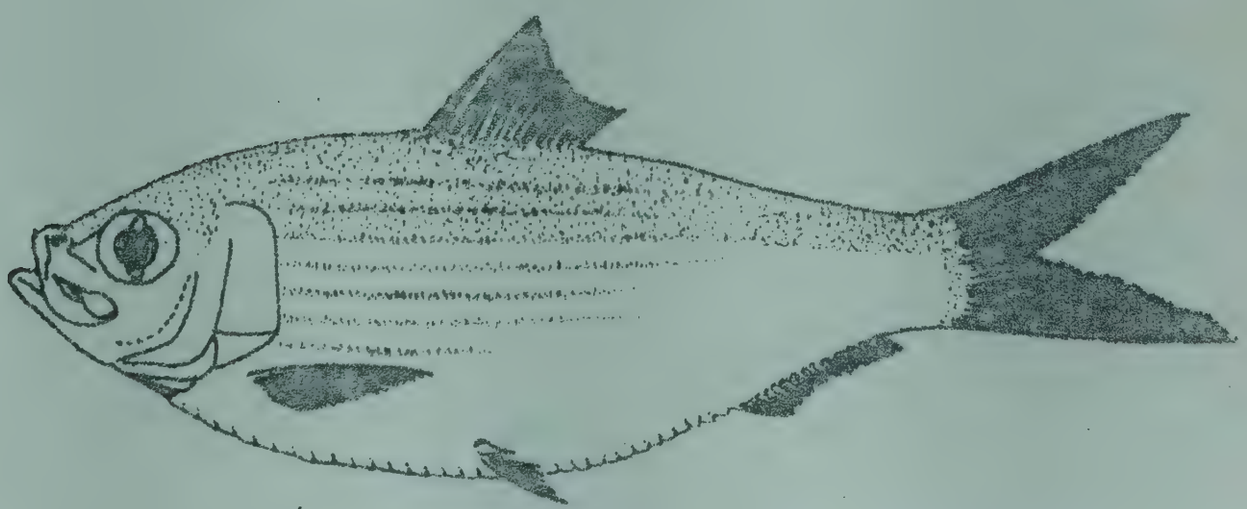


OPISTHOPTERUS TARDOORE TROOORE



PELLONA DITCHELA KATI WHITE BAI

SARDINELLA LONGICEPS PARLI OIL SARDINELLA



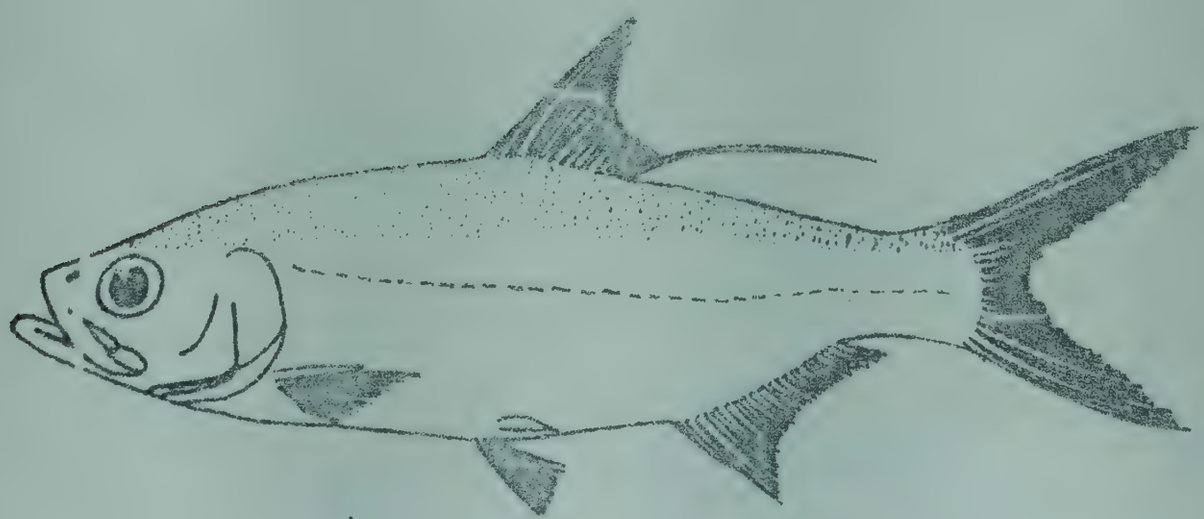
SARDINELLA BRACHYSOMA DEEPBODY SARDINELLA

SARDINELLA ALBELLA WHITE SARDINELLA

SARDINELLA FIMBRIATA PEDWA F. SARDINELLA

SARDINELLA GIBBOSA

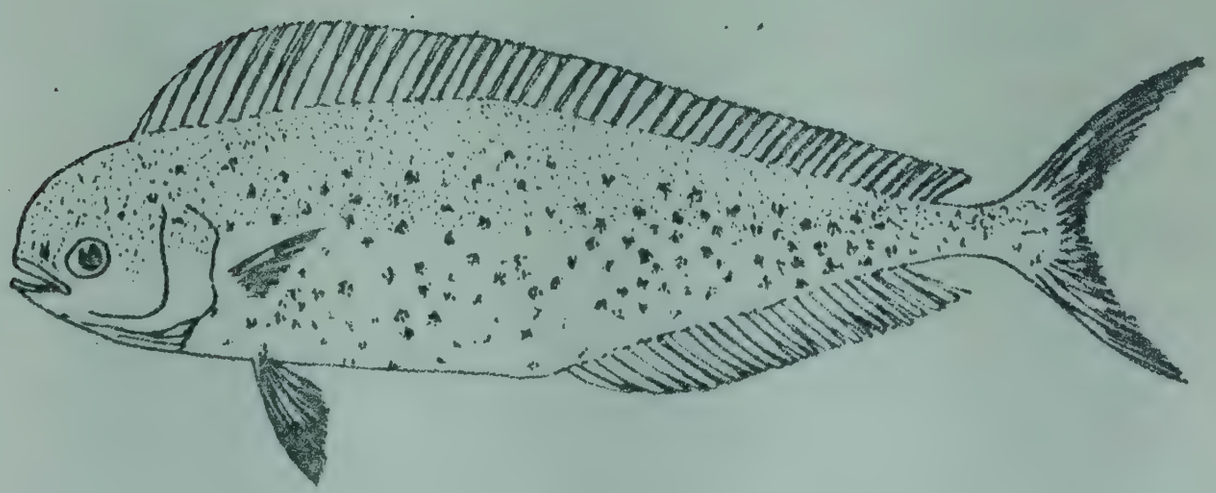
GOLDSTRIPE SARDINELLA



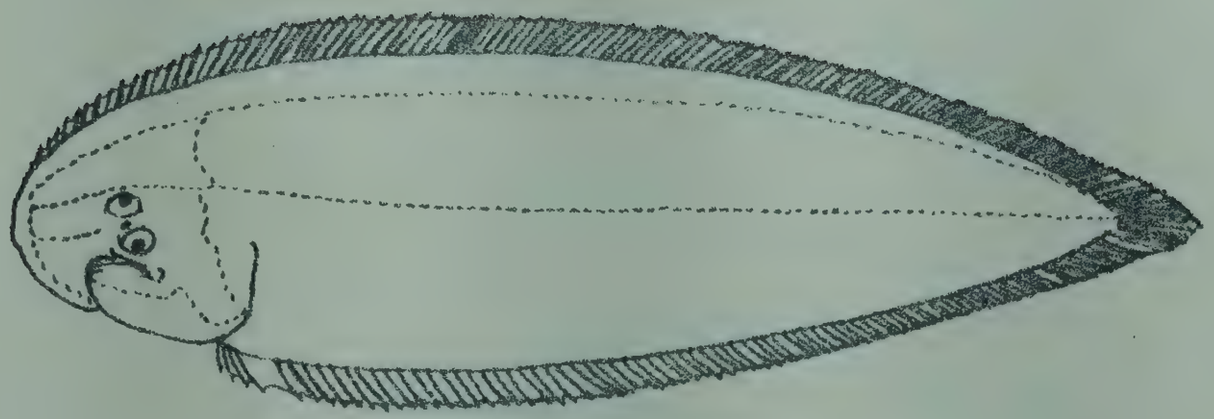
MEGALOPS CYPRINOIDES

INDO-PACIFIC TARPON

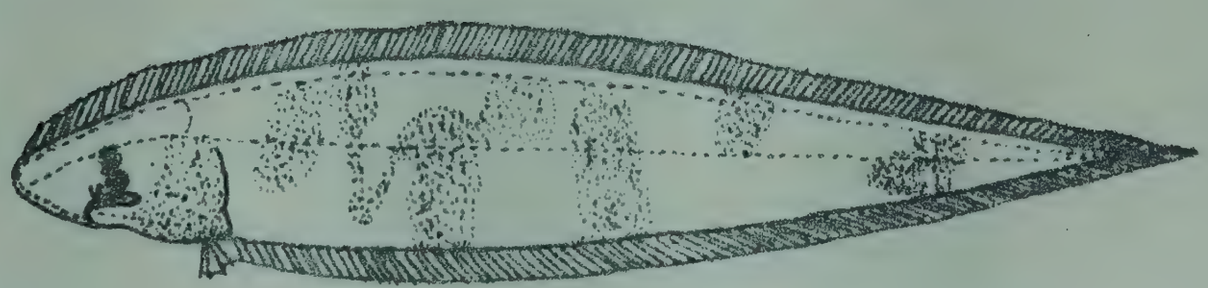
CORGHAENA HIPPURUS COMMON DOLPHINFISH



CORGHAENA EQUISLIS POMPANO DOLPHINFISH

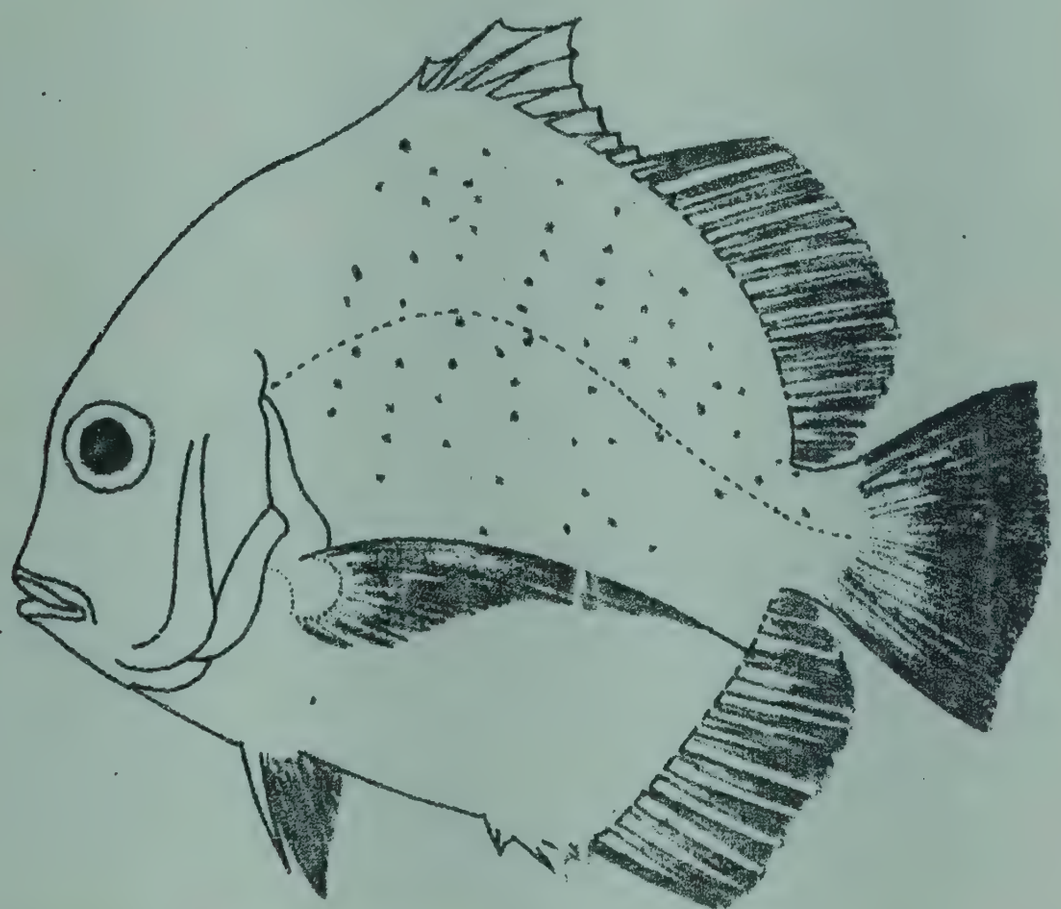


CYNOGLOSSUS BILINEATUS — FOURLINED TONGUE SOLE

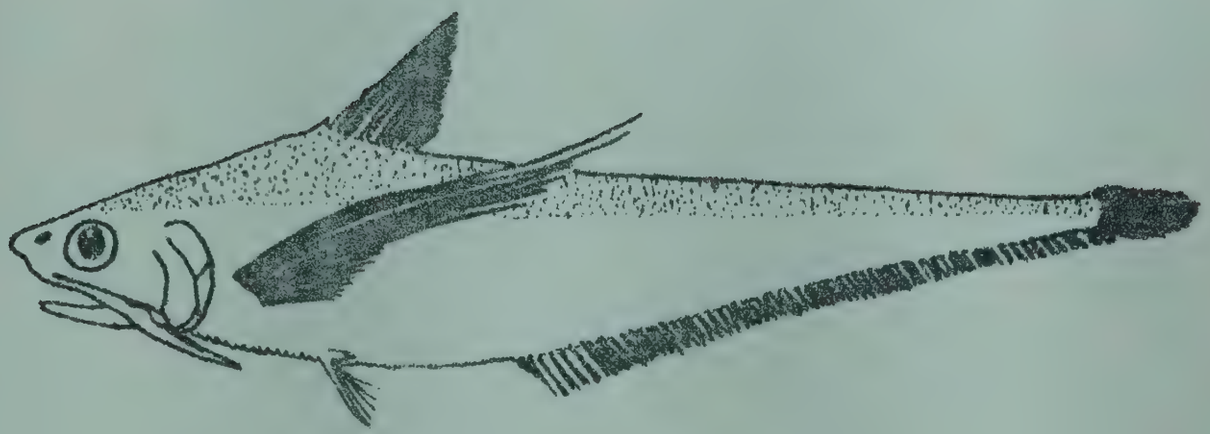


CYNOGLOSSUS LINGUA — LONG TONGUE SOLE

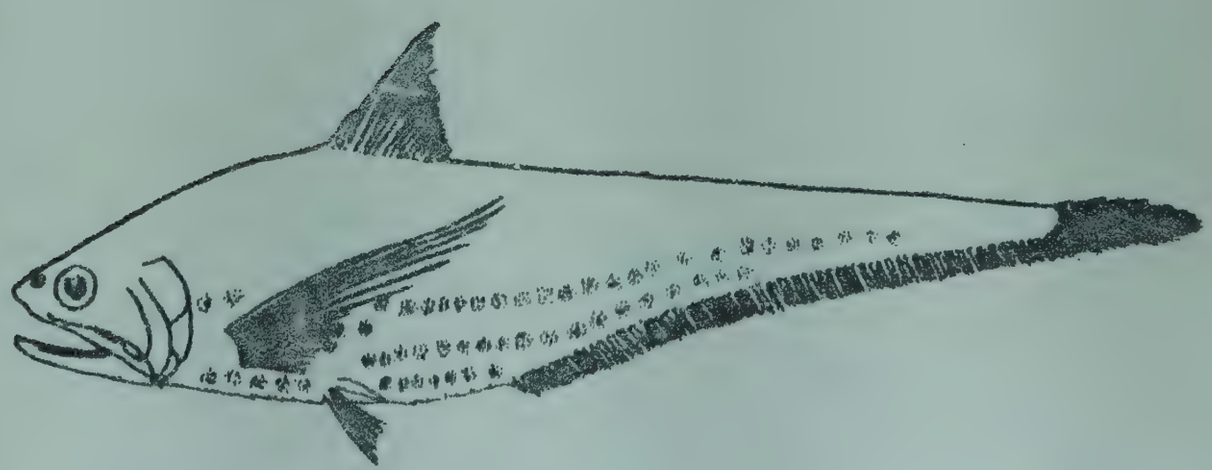
35



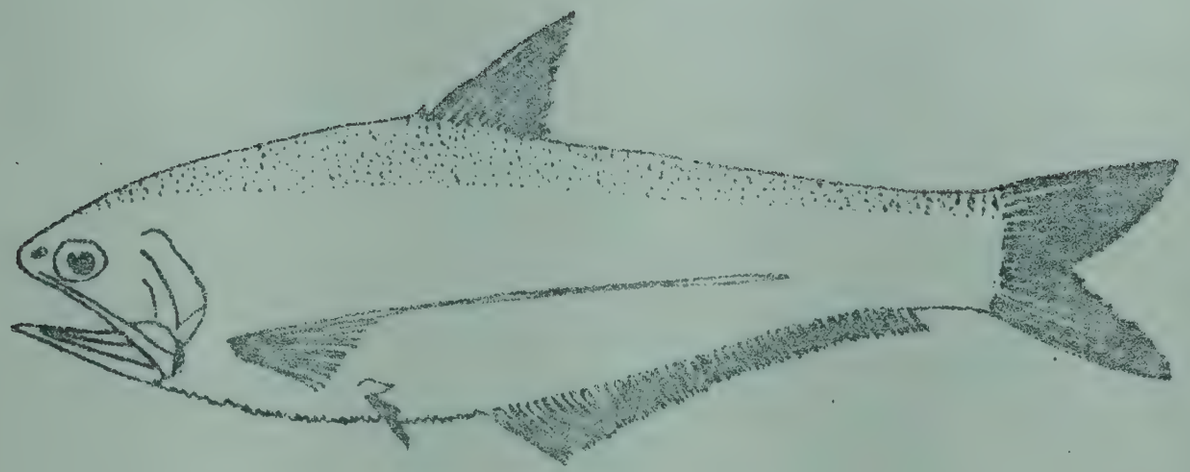
DREPANE PUNCTATA COMAND SPOTTED SICKLEFISH



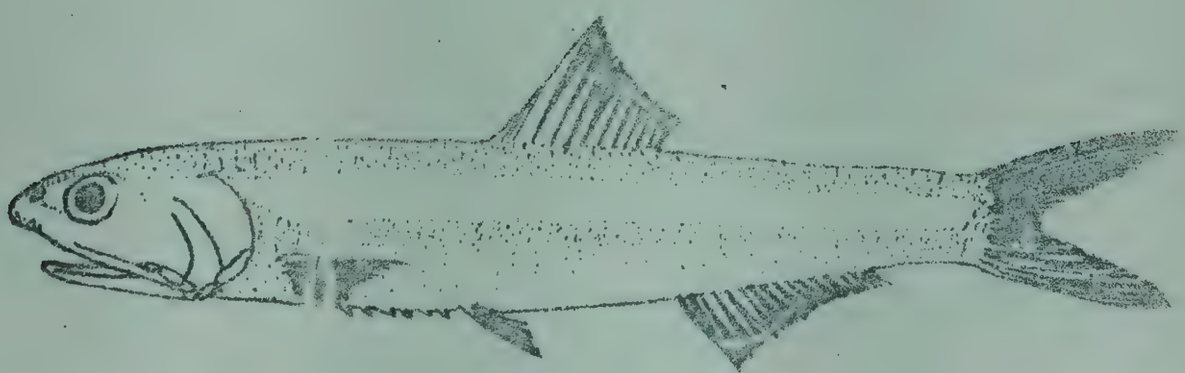
COILIA MACROGNATHUS BIGMOUTH GRENADIER ANCHOVY



COILIA DUSSUMIERI MANDELI GOLD-SPOTTED GRENADIER ANCHOVY



SETIPINNA TATY HAIRFIN ANCHOVY



STOLEPHORUS HETEROLOBUS SHORTHEAD ANCHOVY

STOLEPHORUS TRI — SPINED ANCHOVY

STOLEPHORUS INDICUS — INDIAN ANCHOVY

STOLEPHORUS BUCCANEERI — BUCCANEER ANCHOVY

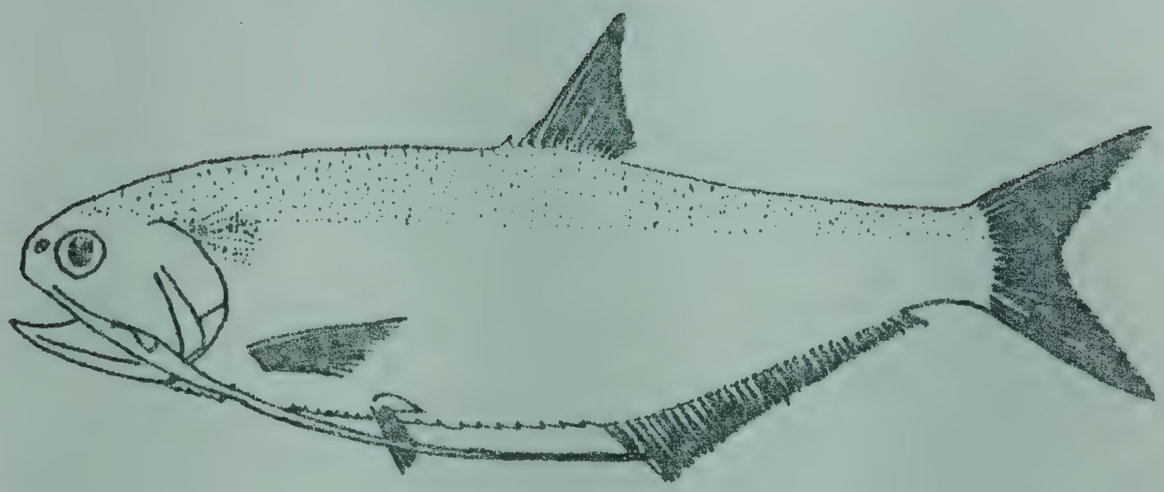
STOLEPHORUS BATAVIENSIS — BATAVIAN ANCHOVY

STOLEPHORUS COMMERSONII — COMMERSON'S ANCHOVY

THRISSINA BAELAMA — BAELAMA ANCHOVY

THRYSSA MYSTAX — MOUSTACHED THRYSSA

THRYSSA VITRIROSTRIS — ORANGEMOUTH THRYSSA



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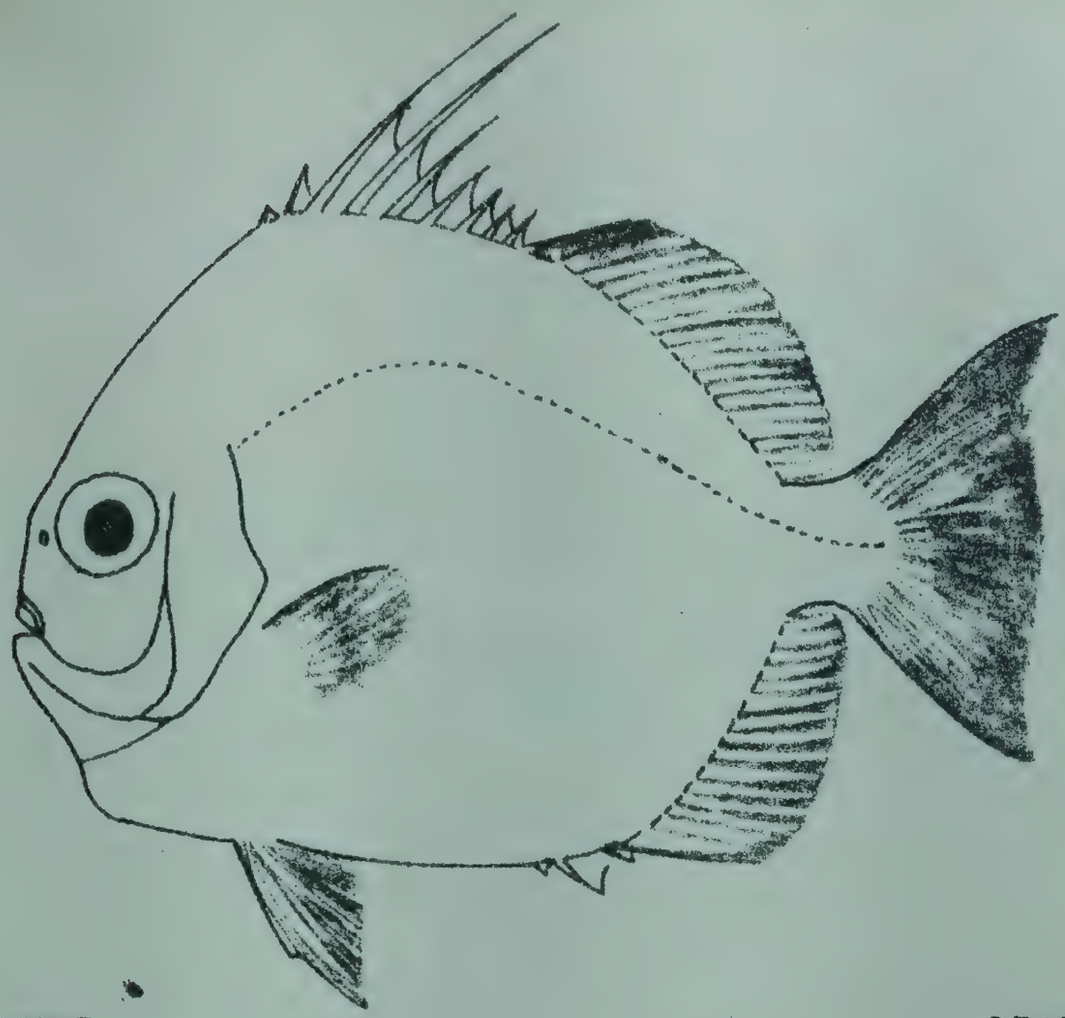
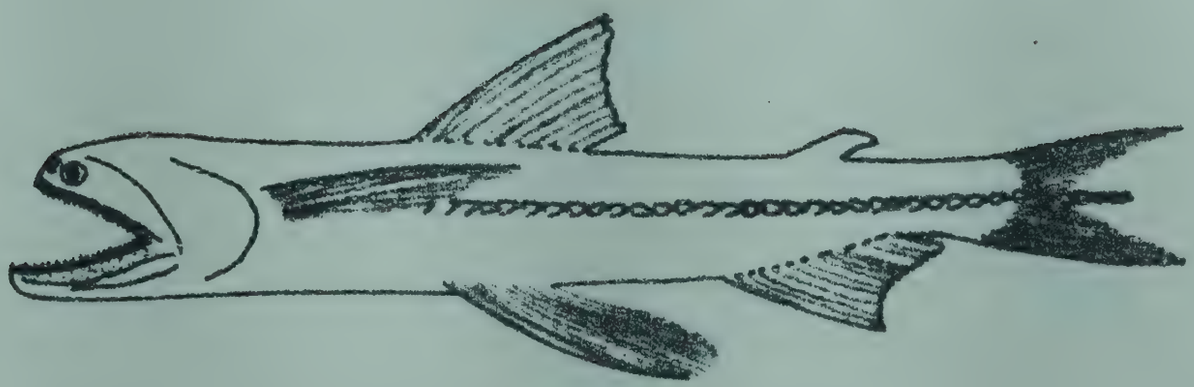
THRYSSA MALABARICA MALABAR THRYSSA

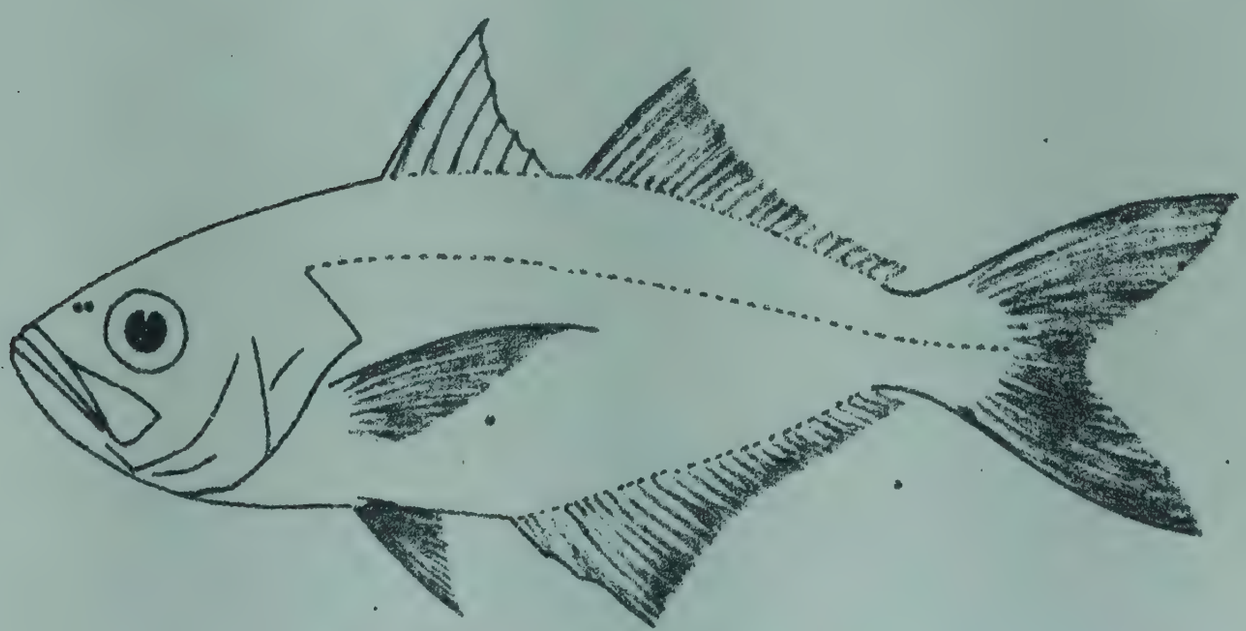


EPHIPPUS ORBIS SPADEFISH

PARASTROMATEUS NIGER HALWA BLACK POMFRET

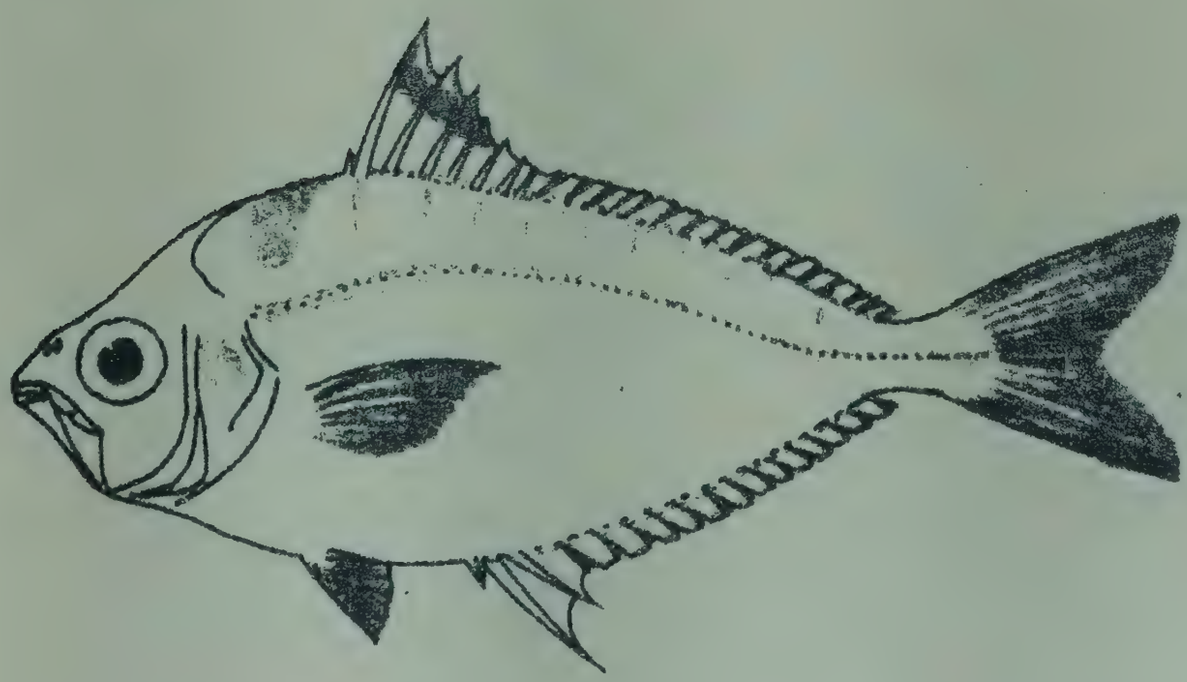


HARPADON NEHEREUS BOMBIL BOMBAY DUCK



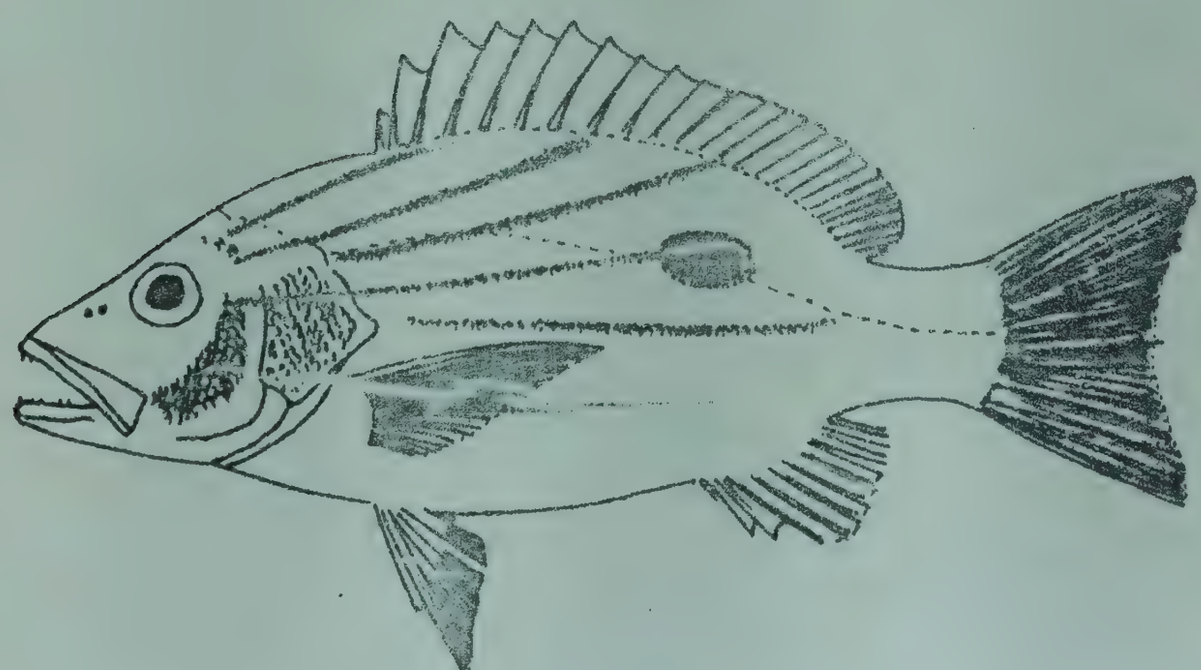
LACTARIUS LACTARIUS PERVI FALSE TREVALLY

LEIOGNATHUS BINDUS KHAPI ORANGEFIN PONYFISH

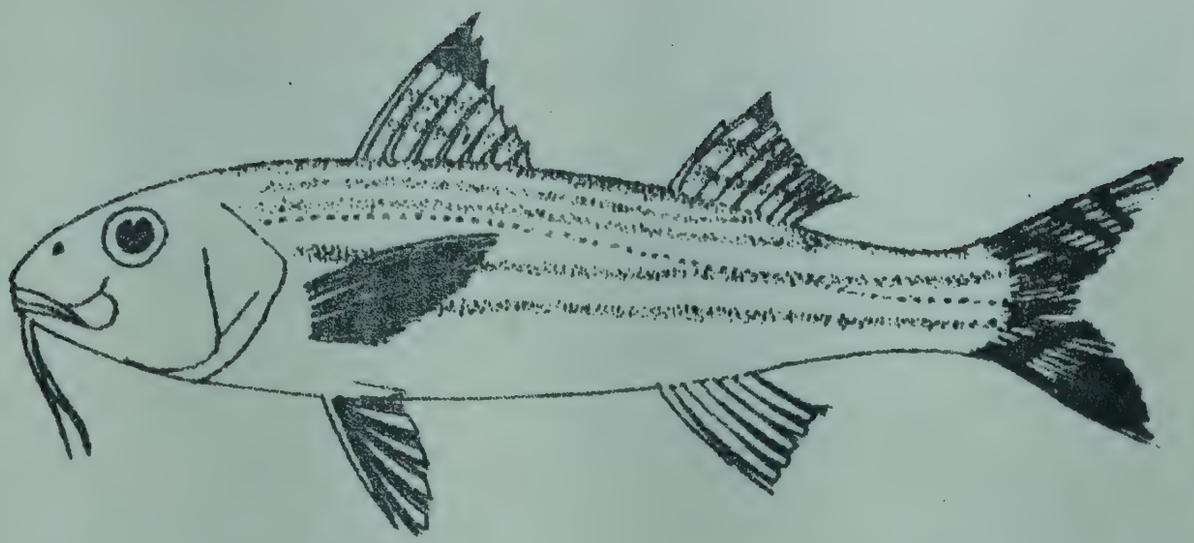


EIOGNATHUS BREVIROSTRIS KHAPI SHORTNOSE PONYFISH

LUTJANUS JOHNI TAMB JOHN'S SNAPPER

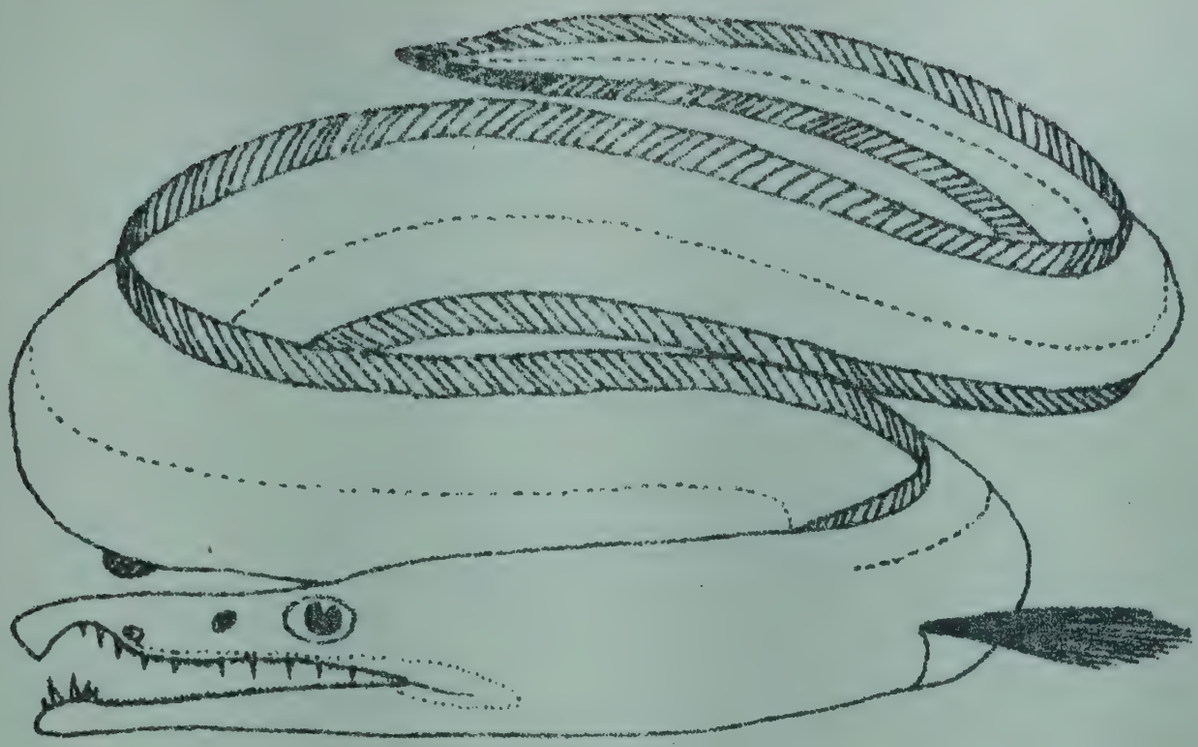


LUTJANUS RUSSELLI TAMB RUSSELL'S SNAPPER

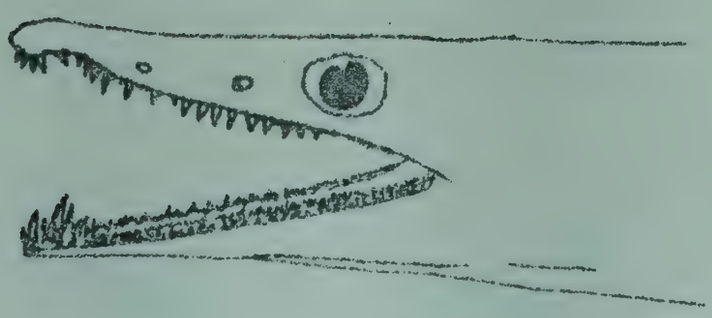


UPENEUS (upeneus) CHIRI GOAT FISH

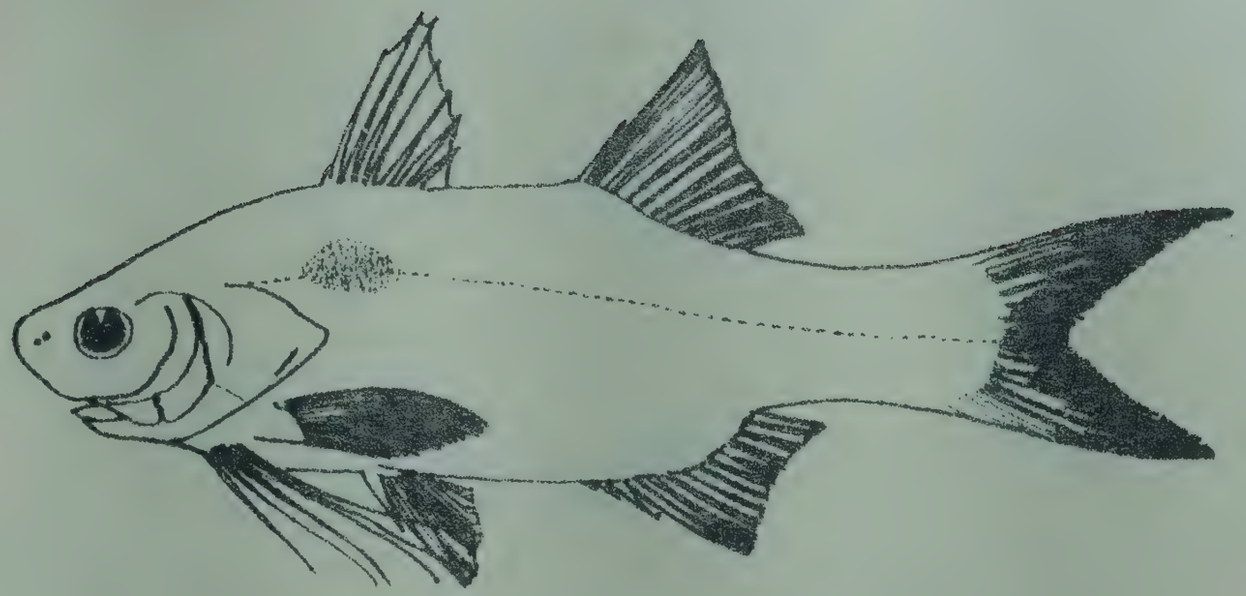
NEMIPTERUS JAPONICUS RANI FISH THREAD FIN BREAM



CONGRESOX TALABON WAM COMMONEEL

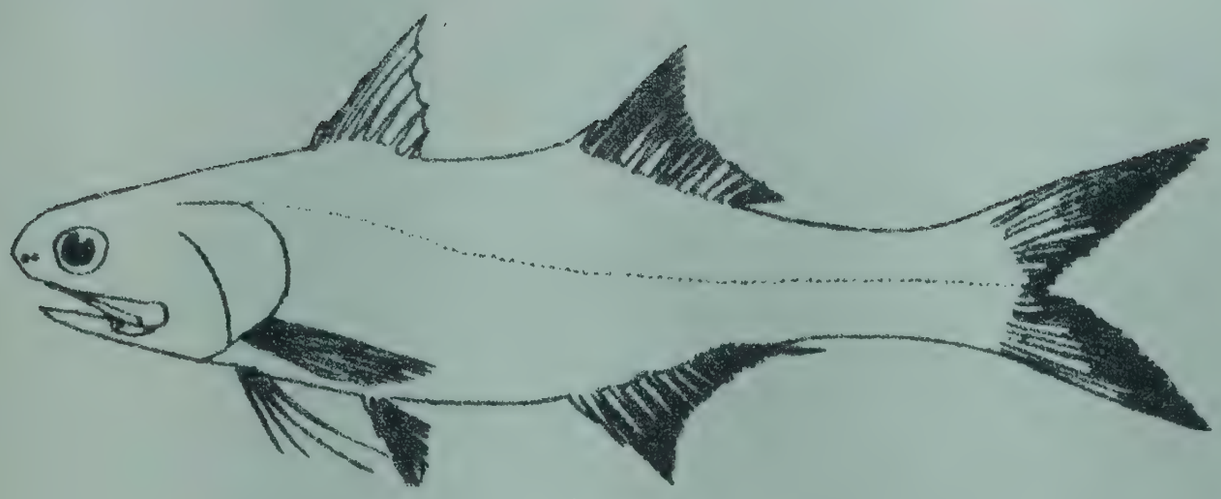


CONGRESOX TALABONOIDES WAM EEL

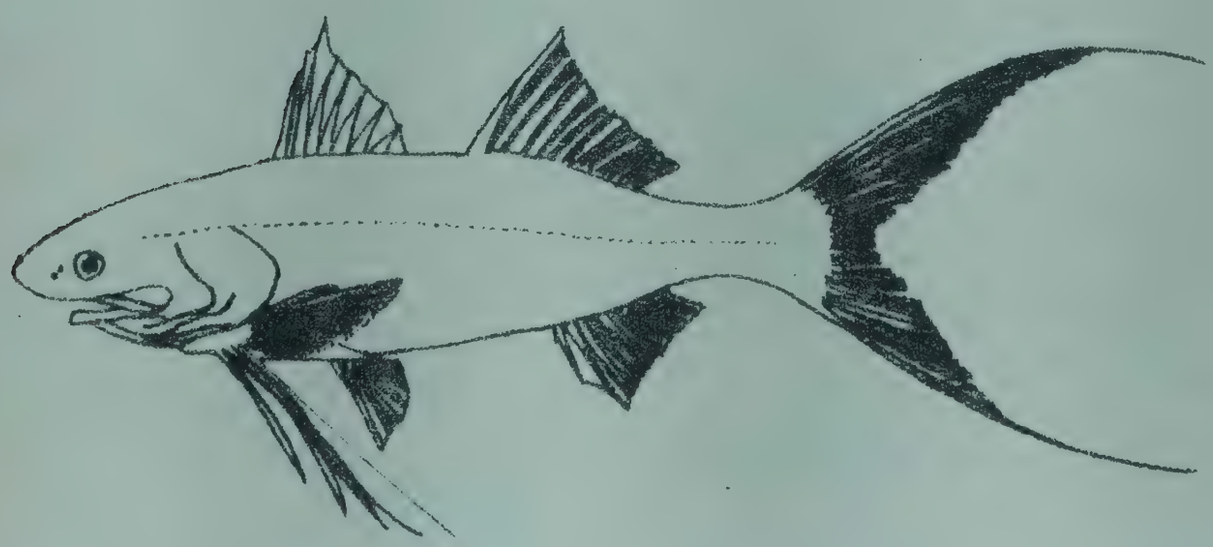


POLYNEMUS SEXTARIUS BLACKSPOT THREADFIN

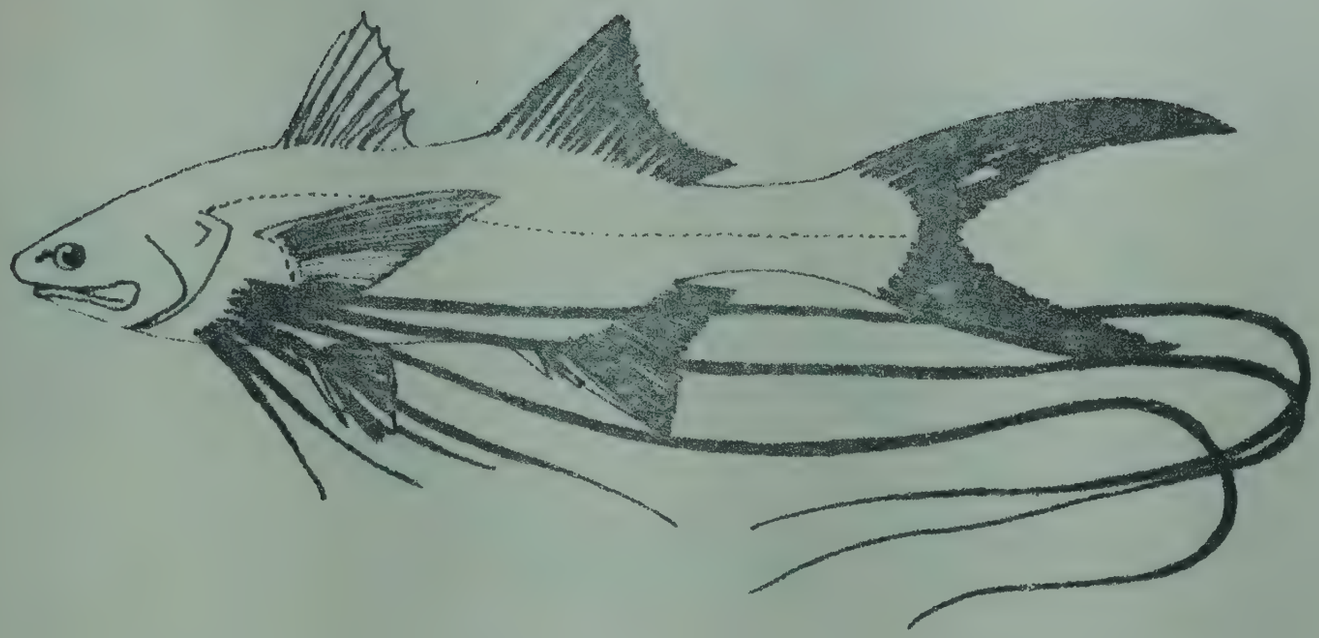
POLYNEMUS HEPTADACTYLUS SEVENFINGER THREADFIN



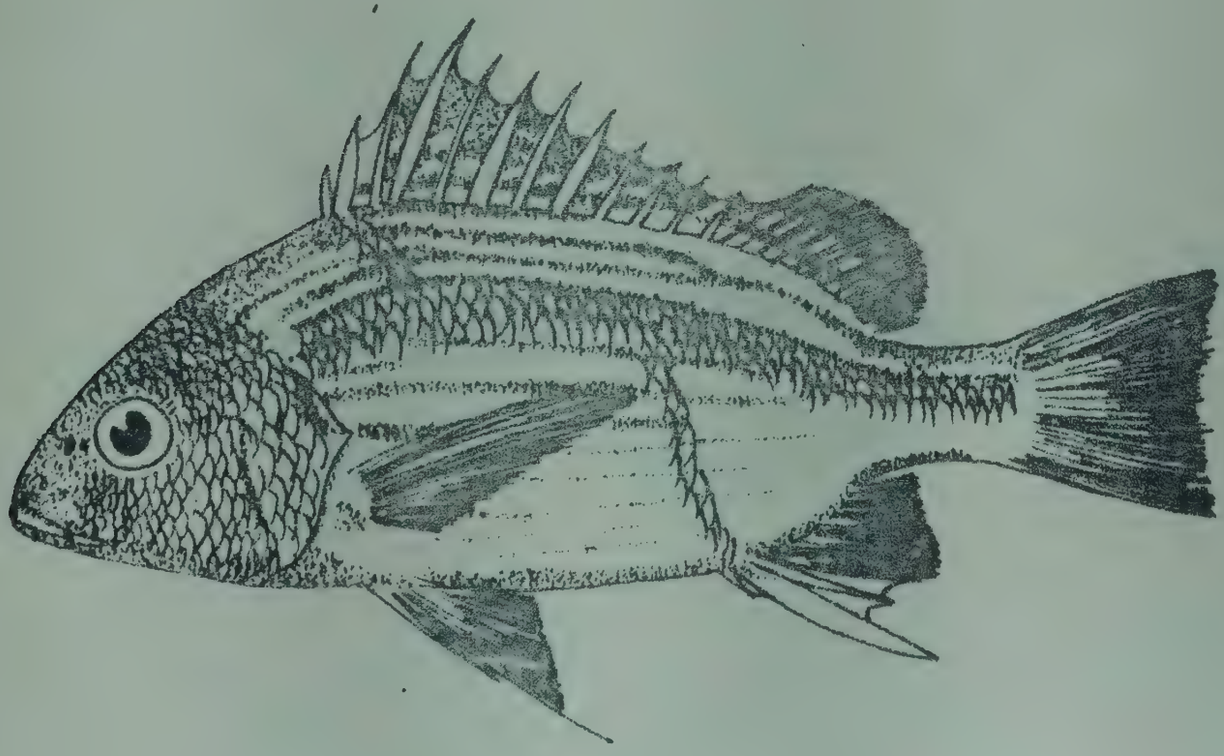
ELEUTHERONEMA TETRADACTYLUM RAWAS INDIAN SALMON



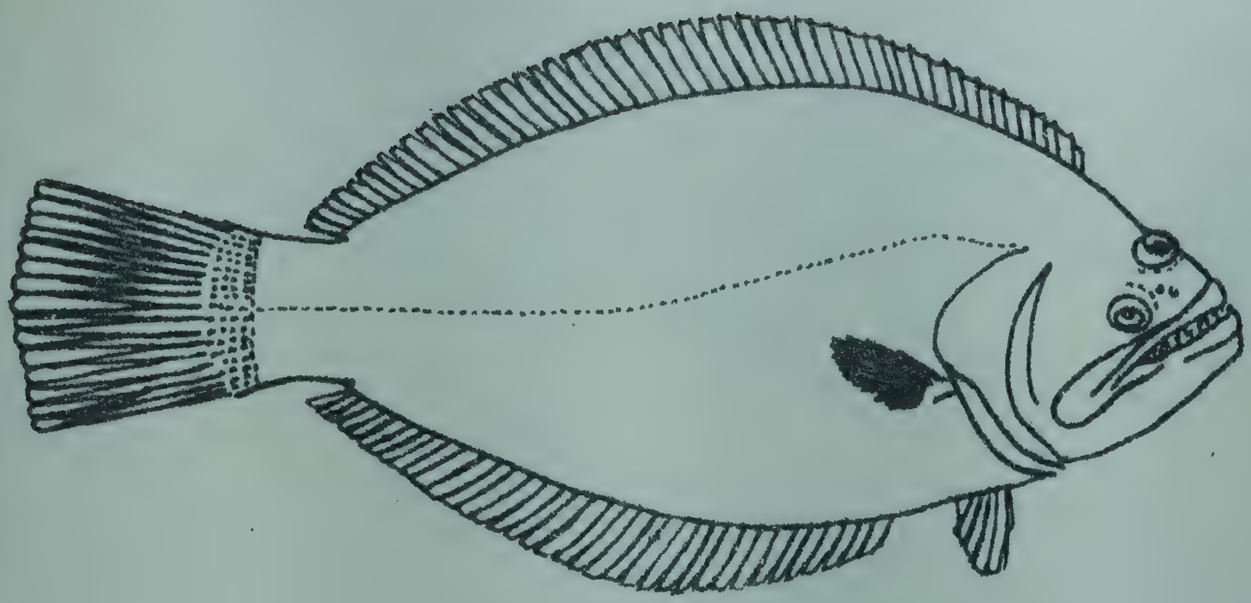
POLYNEMUS INDICUS DARA MONK FISH



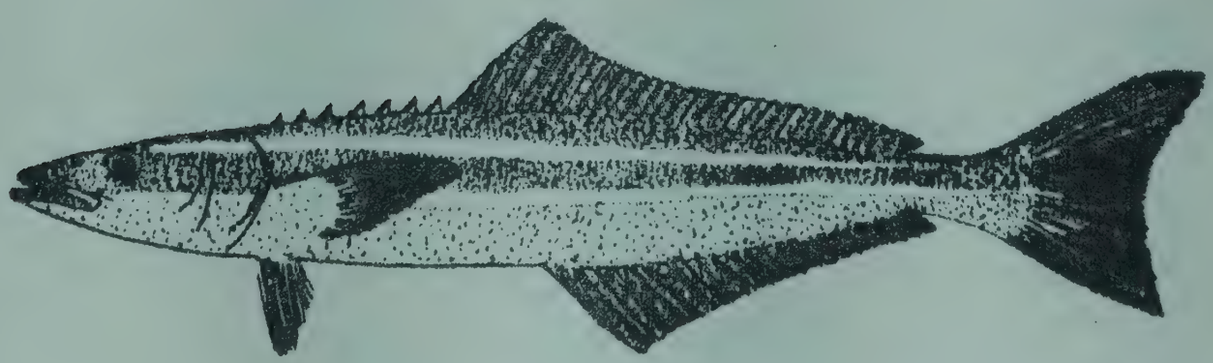
POLYNEMUS PARADISEUS DARA MONK FISH



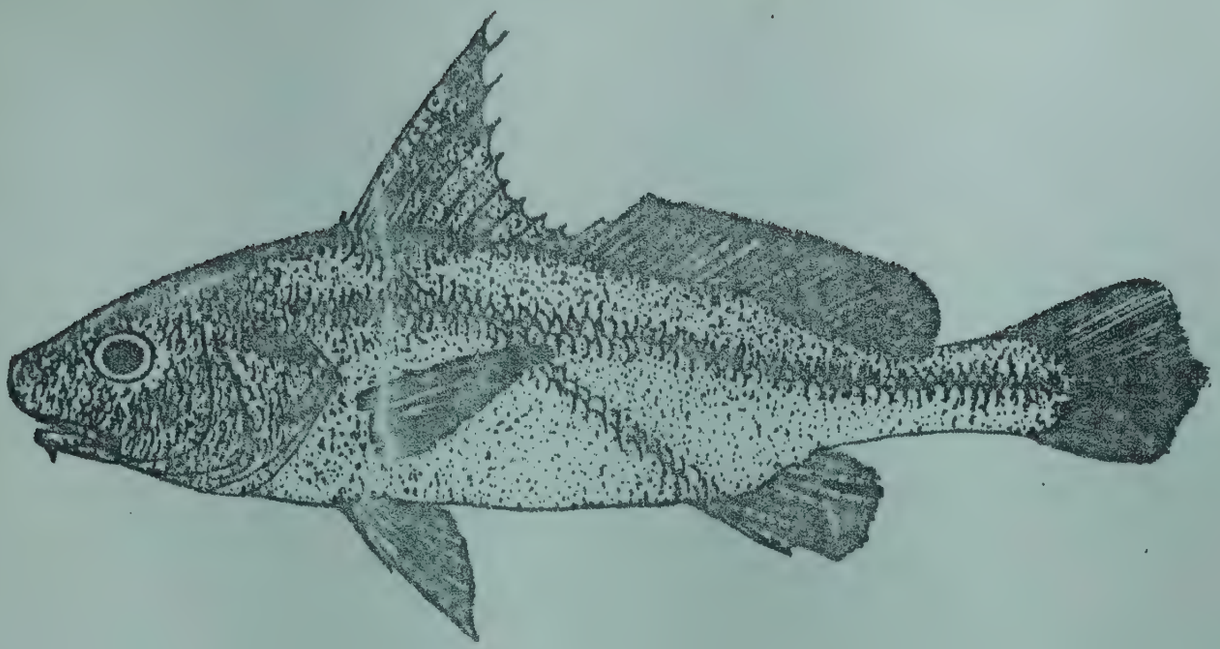
POMADASYS HASTA KARKARA GRUNTER



PSETTODES ERUMEI BHAKAS INDIAN ~~TURBIT~~ HALIBUT



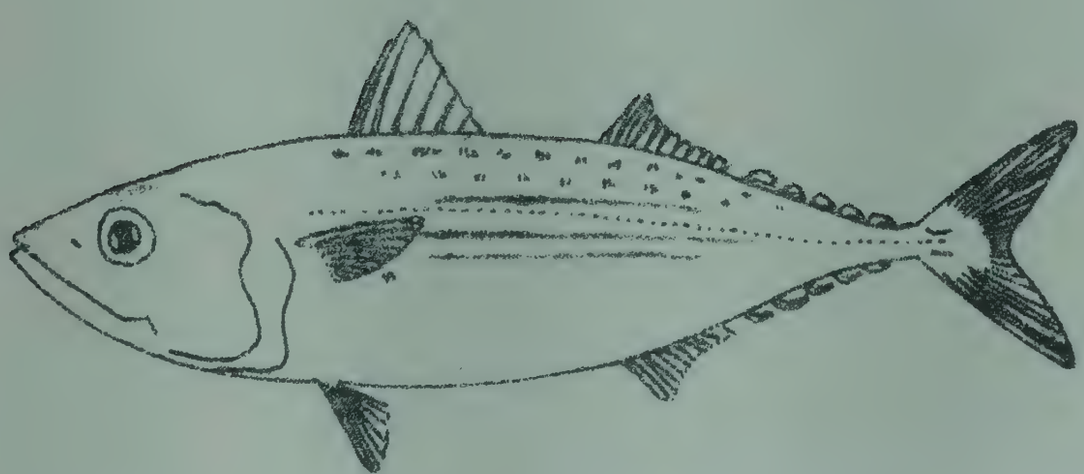
RACHYCENTRON CANADUS SAKLA BLACK KING FISH



JOHNIUS DUSSUMIERI DHOMA CROCKER

OTOLITHOIDES BIAURITUS DORI KOTH

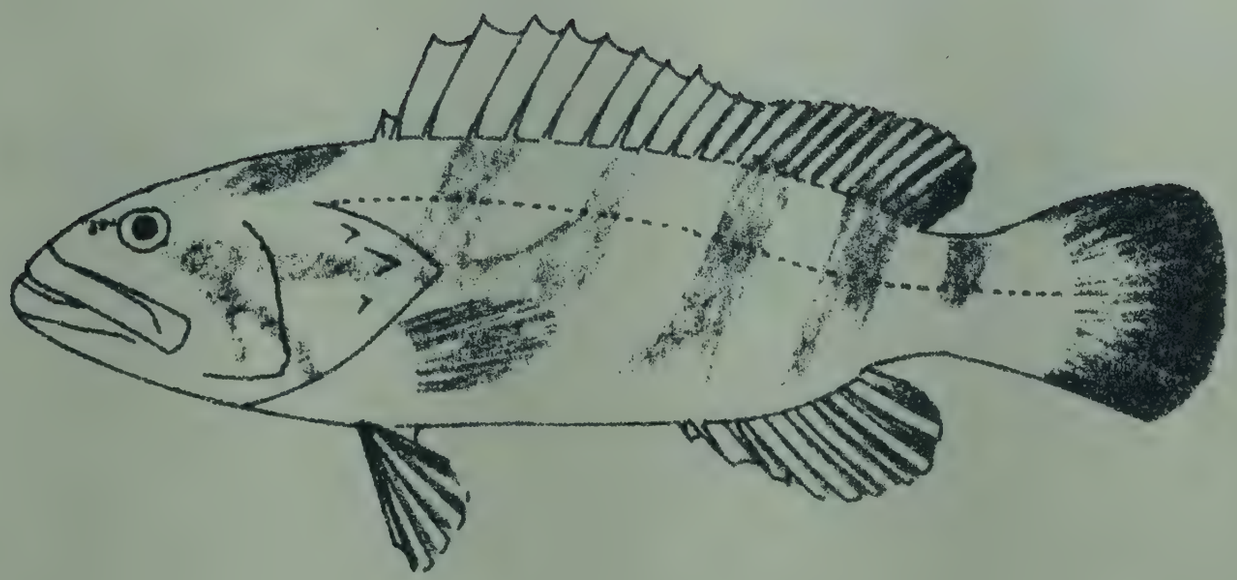
KATSUWONUS PELAMIS KUPPA SKIPJACK TUNA



RASTRELLIGER KANAGURTA BANGADA INDIAN MACKEREL

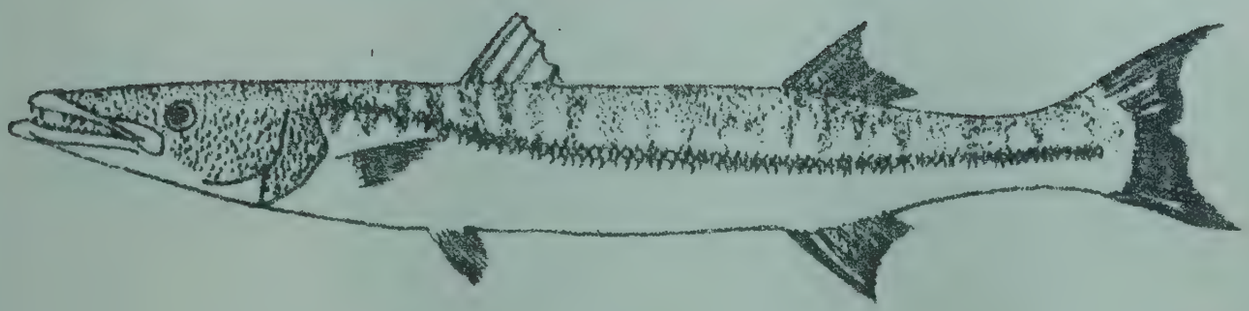
SCOMBEROMORUS COMMERSON — SURAMAI — NARROW-BARRED SPANISH MACKER

SCOMBEROMORUS GUTTATUS — SURAMAI — INDO-PACIFIC SPANISH MACKEREL

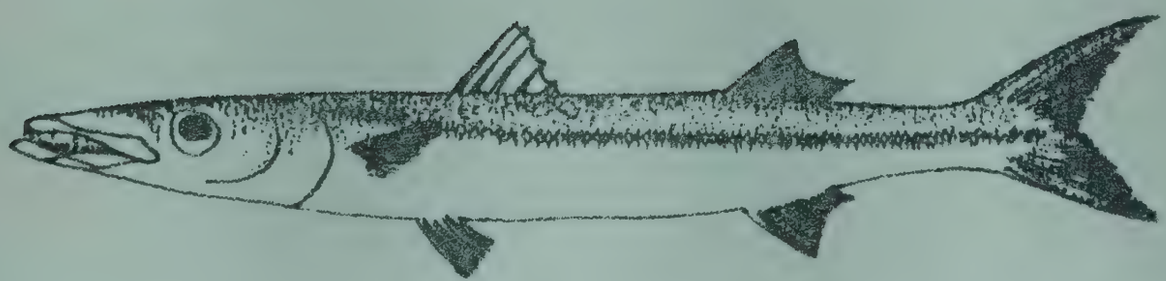


EPINEPHELUS BRUNNEUS GOBRA MUD GROUPER

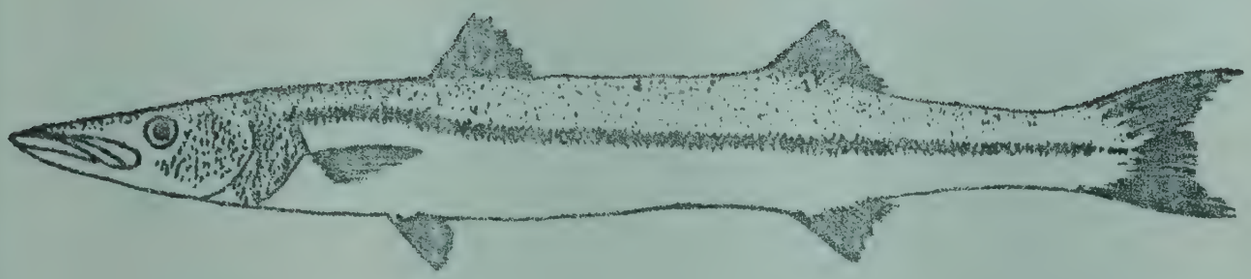
EPINEPHELUS FASCIATUS GOBRA RED-BANDED GROUPER



SPHYRAENA BARRACUDA — GREAT BARRACUDA



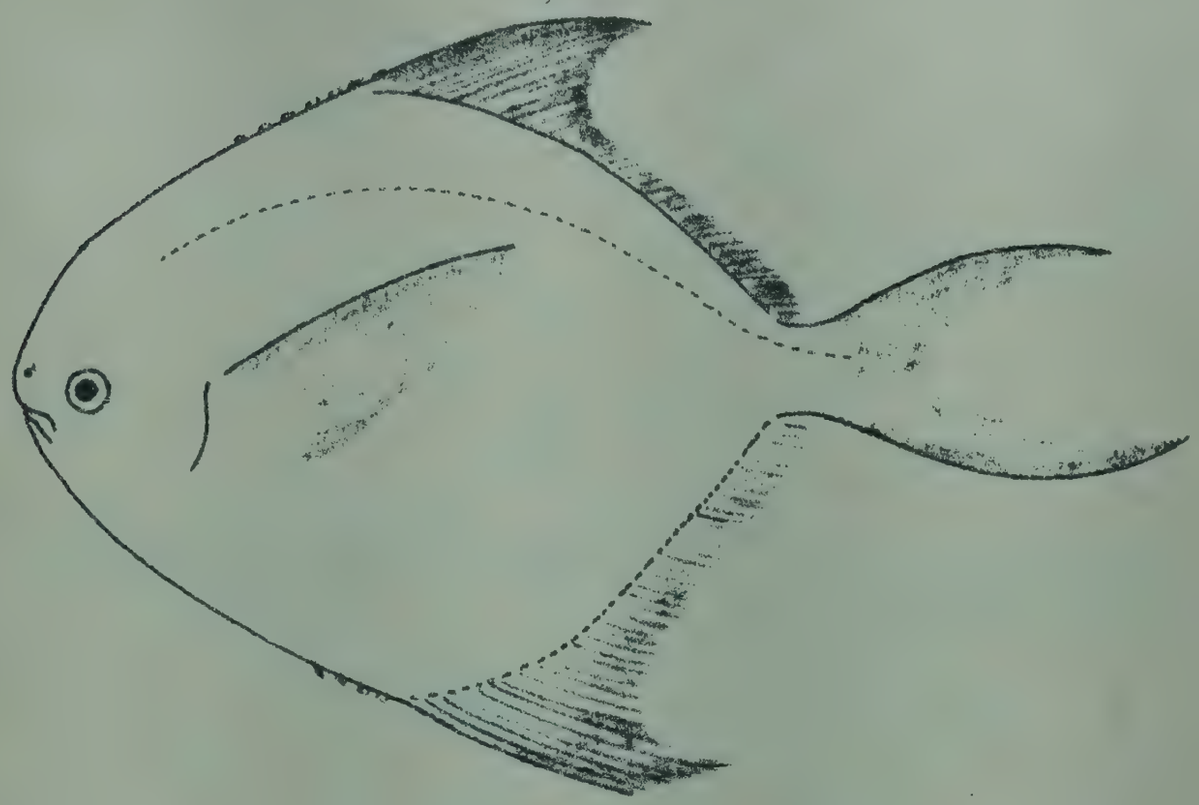
SPHYRAENA FORSTERI — FORSTER'S BARRACUDA



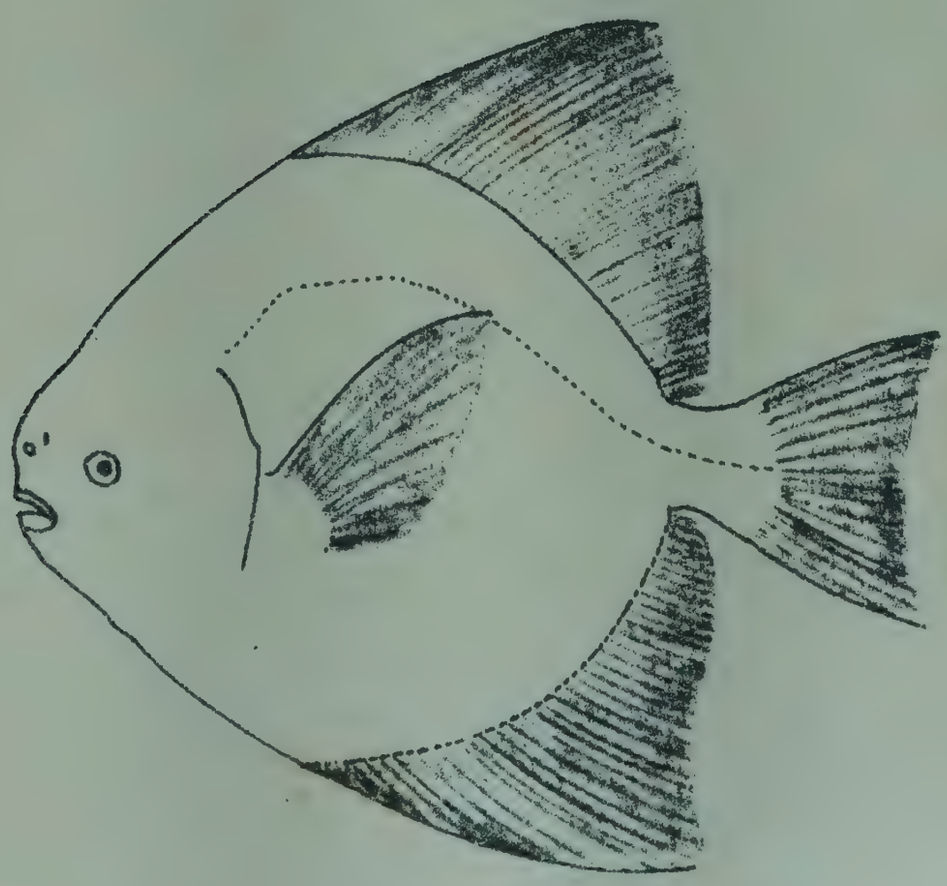
PHYRAENA JELLO ... BANDED BARRACUDA

PHYRAENA OBTUSATA OBTUSE BARRACUDA

41



PAMPUS ARGENTEUS SARANGA SILVER POMFRET



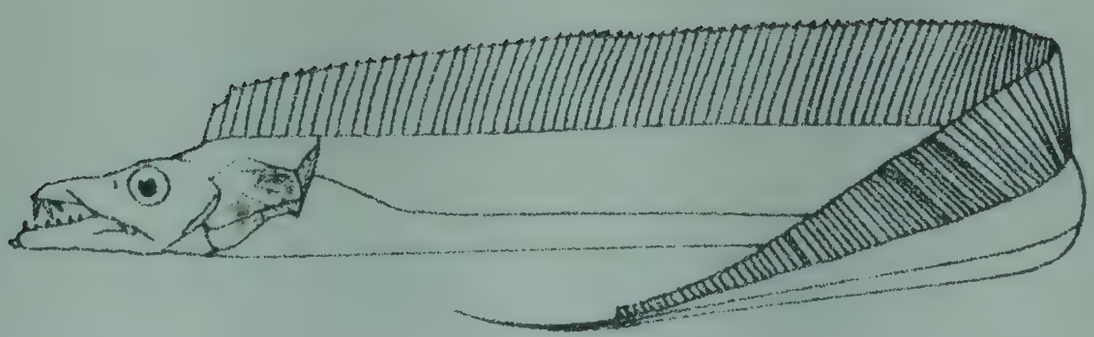
PAMPUS CHINENSIS KALWAD CHINESE POMFRET

SAURIDA TUMBIL CHOR-BOMBIL GREATER LIZARDFISH

THERAPON JARBUA

JARBUA THERAPON

TRICHIURUS SAVALA WAGTI SMALLHEAD HAIRTAIL



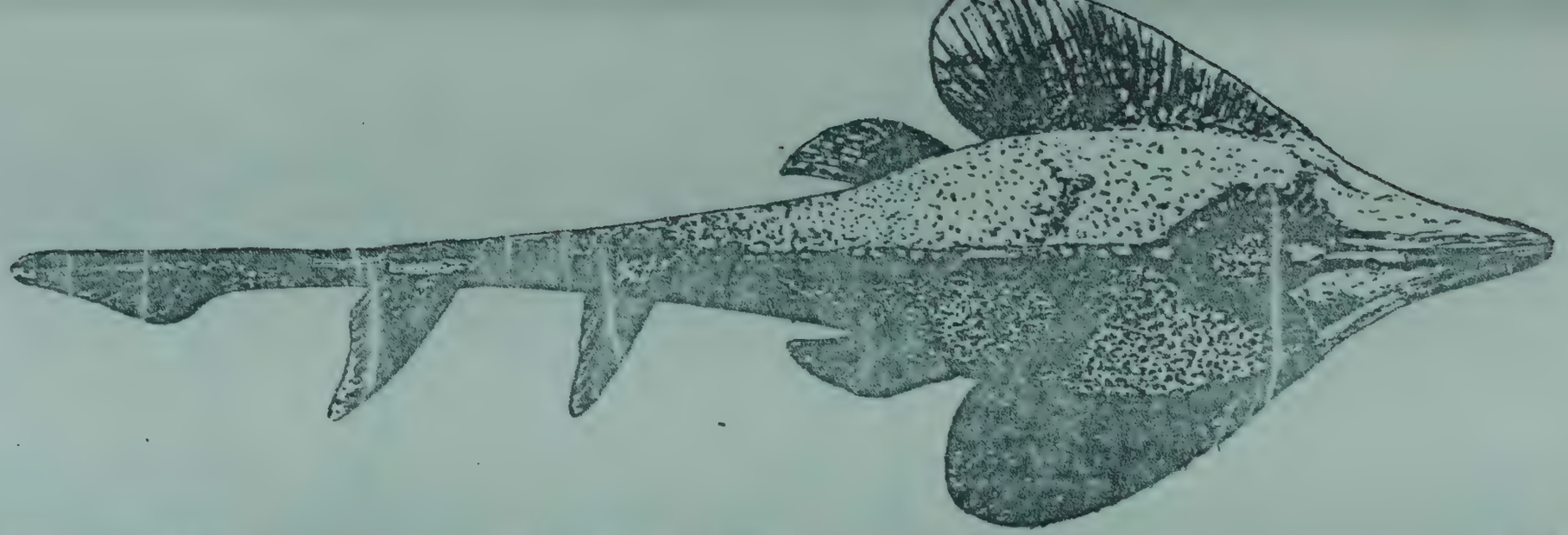
TRICHIURUS LEPTURUS BUGA LARGEHEAD HAIRTAIL

OLIODON SORAKOWAH SOR MUSHI SHARP NOSED SHARK

CARCHARIAS ACUTIDENS KHEDA BLACK FINNED SHARK

ZYGAENA MALLEUS KAUAR HAMMER HEADED SHARK

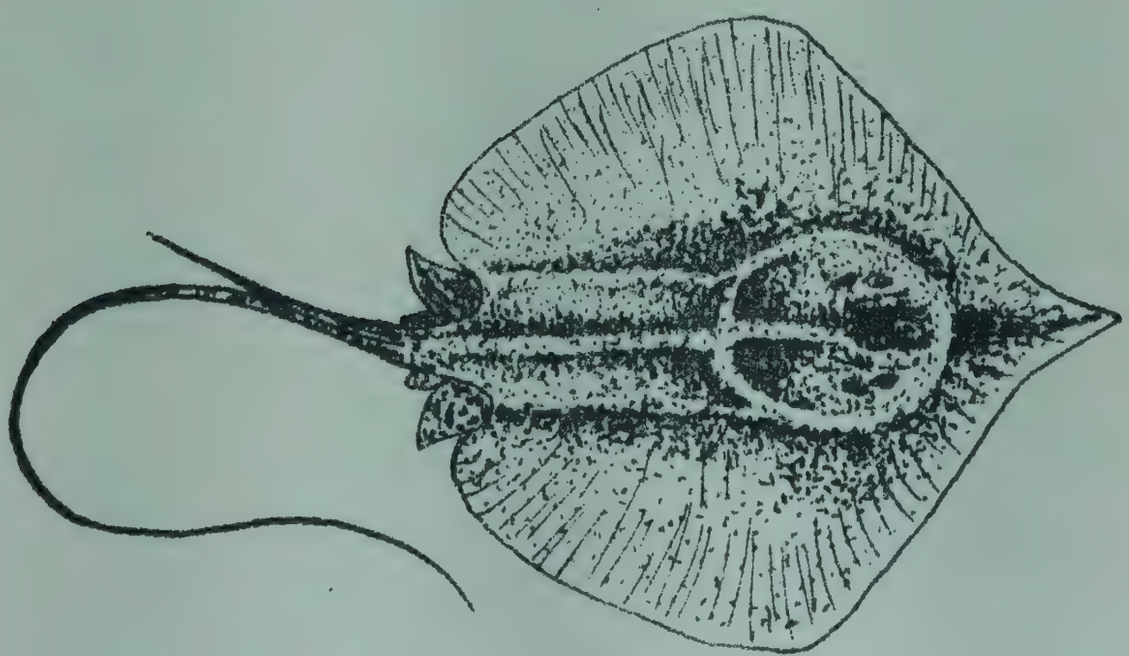
STEGOSTOMA TIGRINUM TIGER SHARK



RHINOBATUS THOUINI RANJER LAWJ SKATE

PRISTIS CUSPIDATUS MALI SAW FISH

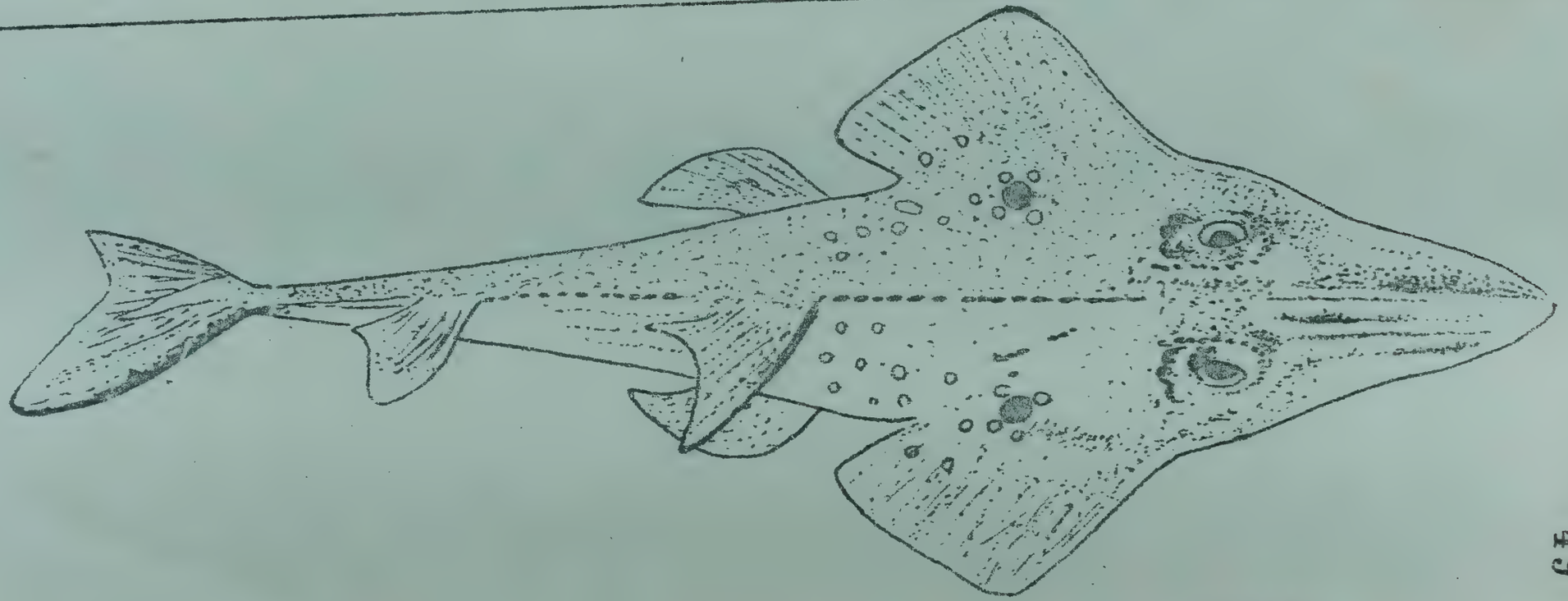
DKEROBATIS EREGOODOO DVILRAY



TRYGON ZUGEI PAKAT STING RAY

NARCINE TIMLEI

ELECTRIC RAY



RHYNCHOBATUS DJEDDENSIS

SKATE

PTEROPLATEA MICRURA RAY

TRYGON WALGA RAY

Family	Scientific name	Local name	English name	Plate No.
ARIIDAE	Arius caelatus	Shingada	Engraved cat fish	1
	Arius maculatus	Shingada	Spotted cat fish	1
	Arius thalassinus	Shingada	Giant cat fish	2
	Asteogeniosus militaris	Shingada	Soldier cat fish	2
BALISTIDAE	Balistes niger	-	-	3
BOTHIDAE	Pseudorhombus arius	-	Large tooth flounder	4
	Pseudorhombus elevatus	-	Deep flounder	4
CARANGIDAE	Atropus atropus	-	Kowch travelly	5
	Carangoides malabaricus	-	Malabar cavalla	5
	Decapterus macrosoma	-	Layang scad	6
	Trachinotus blochii	-	Snubnose pompano	6
	Megalaspis cordyla	Karkatu Bangada	Horse mackerel	7
CHIROCENTRIDAE	Chirocentrus dorab	Karli	Dorab fish	8
	Chirocentrus nudus	Karli	Dorab fish	8
CLUPEIDAE	Hilsa toli	Bhing	Giant herring	9
	Ilisiha elongata	Pala	Indian shad	9
	Opisthopterus tardoore	-	Long finned herring	10
	Pellona ditchela	Kati	White bail	10
	Sardinella longiceps	Tarli	Oil sardine	11
	Sardinella brachysoma	-	Deep bodied sardinella	11
	Sardinella albella	-	White sardinella	12
	Sardinella fimbriata	Pedwa	Fringe scale sardine	12
	Sardinella gibbosa	-	Gold striped sardinella	13

Family	Scientific name	Local name	English name	Plate No.
CORYPHAENIDAE	Corghaena hippurus	-	Common dolphin fish	14
	Corghaena equilis	-	Pompano dolphin fish	14
CYANOGLOSSIDAE	Cyncglossus bilineatus	-	Four lined tongue sole	15
	Cynoglossus lingua	-	Long tongue sole	15
DREPANIDAE	Drepane punctata	Chand	Spotted sickle fish	16
GYMNODONTES	Tetrodon inermis	-	Puffer fish	3
ENGRAULIDAE	Coilia macrognathus	Mandeli	Big mouth granadier anchovy	17
	Coilia dussumieri	Mandeli	Gold spotted granadier anchovy	17
	Dussumeria acuta	Mandeli	Anchovy	7
	Setipinna taty	-	Hair fin anchovy	18
	Stolephorus Heterolobus	-	Short head anchovy	18
	Stolephorus tri	-	Spined anchovy	19
	Stolephorus indicus	-	Indian anchovy	19
	Stolephorus buccaneeri	-	Buccaneer anchovy	20
	Stolephorus bataviensis	-	Batavian anchovy	20
	Stolephorus commersonii	-	Commerson's anchovy	21
	Thrissina baelama	-	Baelama anchovy	21
	Thryssa mystax	-	Moustached thryssa	22
	Thryssa vitriorostris	-	Orange mouth thryssa	22
	Thryssa setirostis	-	Long jaw thryssa	23
	Thryssa malabarica	-	Malabar thryssa	23
EPHIPPIDAE	Ephippus orbis	-	Spade fish	24
FORMINOIDAE	Parastromateus niger	Halwa	Black pomfret	24
HARPODONTIDAE	Harpodon nehereus	Bombil	Bombay duck	25
LACTARIDAE	Lactarius lactarius	Pervi	False trevally	25

Family	Scientific name	Local name	English name	Plate No.
EIOGNATHIDAE	Leiognathus bindus	Khapi	Orange fin pony fish	26
	Leiognathus brevirostris	Khapi	Shortnosed pony fish	26
LUTJANIDAE	Lutjanus johni	Tamb	John's snapper	27
	Lutjanus russelli	Tamb	Russel's snapper	27
MEGALOPIDAE	Megalops cyprinoides	-	Indo pacific tarpon	13
MULLIDAE	Upeneus upeneus	Chiri	Goat fish	28
MURAENOSOCIDAE	Congresox talabon	Wam	Common eel	29
	Congresox talabonoides	Wam	Eel	29
NEMIPTERIDAE	Nemipterus japonicus	Rani fish	Thread fin bream	28
POLYNEMIDAE	Polynemus sextarius	-	Black spot thread fin	30
	Polynemus heptadactylus	-	Seven fingers thread fin	30
	Eleutheronema tetradactylum	Rawas	Indian salmon	31
	Polynemus indicus	Dara	Monkfish	31
	Polynemus paradiseus	Dara	Monkfish	32
POMADASYIDAE	Pomadasys hasta	Karkara	Grunter	32
PSETTODIDAE	Psettodes erumei	Bhakas	Indian halibut	33
RACHYCENTRIDAE	Rachycentron canadus	Sakla	Black king fish	33
SCIAENIDAE	Johnius dussumieri	Dhoma	Crocker	34
	Otolithoides biauritus	Dori	Koth	34
	Otolithes ruber	-	Tiger toothed croaker	35
	Sciaenoides brunneus	Koth	Dori	35

Family	Scientific name	Local name	English name	Plate No.
SCOMBRIDAE	Katsuwonus pelamis	Kuppa	Skipjack tuna	36
	Rastrelliger kanagurta	Bangada	Indian mackerel	36
	Scomberomorus commerson	Suramai	Narrow barred spanish mackerel	37
	Scomberomorus guttatus	Suramai	Indo-pacific spanish mackerel	37
SERRANIDAE	Epinephalus brunneus	Gobra	Mudgrouper	38
	Epinephalus fasciatus	Gobra	Red banned grouper	38
SPHYRAENIDAE	Sphyraena barracuda	-	Great barracuda	39
	Sphyraena forstreri	-	Forster's barracuda	39
	Sphyraena jello	-	Bawded barracuda	40
	Sphyraena obtusata	-	Obtuse barracuda	40
STROMATIDAE	Pampus argenteus	Saranga	Silver pomfret	41
	Pampus chinensis	Kalwad	Chinese pomfret	41
SYANODONTIDAE	Saurida tumbil	Chor bombil	Greater lizard fish	42
THERAPONIDAE	Therapon jarbua	-	Jarbua therapon	43
TRYCHIURIDAE	Trichiurus savala	Wagti	Small head hair tail	44
	Trichiurus lepturus	Buga	Large head hair tail	44
ELASMOBRANCHS				
CARACHARIDAE	Scolidon sorakowah	Sor mushi	Sharp nosed shark	45
	Carcharias acutidens	Kheda	Black finned shark	45
	Zygaena malleus	Kauar	Hammer headed shark	46

Family	Scientific name	Local name	English name	Plate No.
MYLIOBATIDAE	Dicero batis	-	Devil ray	48
PRISTIDAE	Pristis cuspidatus	Mali	Saw fish	47
RHINOBATIDAE	Rhino batus thouini	Ranjer Lawz	Skate	47
	Rhynchobatus djeddensis	-	Skate	49
SCYLLIDAE	Stegostoma tigrinum	-	Tiger shark	46
TORPEDINIDAE	Narcine timlei	-	Electric ray	49
TRYGONIDAE	Pteroplatea micrura	-	Ray	50
	Trygon zugei	Pakat	Sting ray	48
	Trygon walga	-	Ray	50